ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor

A. E. KNOWLTON
Associate Editor

E. R. SEARLES
News Editor

G. F. WITTIG
Statistical Editor

EARL WHITEHORNE
Contributing Editor

JAMES H. RUDD
Publishing Director

FRANK B. INNES
Western Editor
520 N. Michigan Ave.
Chicago

C. W. LEIHY
Pacific Coast Editor
883 Mission St.
San Francisco

H. S. KNOWLTON
Contributing Editor
1427 Statler Bldg.
Boston

PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

What in the World!

Just as soon as the electrical manufacturers' code is approved in final form we expect to publish it and to interpret it. The interpretation is difficult in spots and opinions may differ. Prospects are bright for early Presidential approval and our weekly news service will enable us to keep the industry informed of current developments.

●

Costs are now weighed. In this issue R. J. Gaudy presents a thesis that engineers spend too much money to attain perfection. His conclusions will be debated. If an irate customer calls up and complains of service no explanation that involves costs will satisfy him or give him the service he desires. Undoubtedly, however, financial considerations must be weighed more carefully in future engineering installations.

●

Modernization is the only answer to industrial developments. The codes limit increases in capacity but do not prevent modernization. The unusual story of bringing old waterwheels up-to-date by T. C. Stabley in this issue cannot be duplicated often. Modernization means new and improved equipment.

●

We made some remarks about vibrating conductors in a recent editorial. This started an argument and made us investigate remedies at first hand. Now we are glad to admit that the Stockbridge dampers will overcome vibration on existing lines almost completely. But we are still at sea in regard to the relative merits of the chemical and crystallization theories of fatigue.

Photo courtesy General Electric Co.

AUGUST 5, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.
VOLUME 102 . . . NUMBER 6

Modernizing Pioneer Waterwheels 172
By T. C. STABLEY, *Pennsylvania Water & Power Company*

The Capital Crime 177
By R. J. GAUDY, *Consulting Engineer*

Yardsticks for Power Sales 179
By DEAN W. TAYLOR, *Utility Management Corporation*

Improving Service with Automatic Control .. 182

Asphalt Emulsion Reduces Insulation Radio Troubles 185
By F. O. MCMILLAN, *Oregon State College*

Coal-Handling Costs for Powdered-Fuel Plant 176
36,000 Kw. in Public Utilities 181
Extinguishing Internal Transformer Fires 184
More Use with Reduced Rate 184
Increment Power Definitions 187
Metallic Transformer Paints Cut Capacity in Winter 188
Prevention of Pitting in Stand-by Boilers 189
Readers' Forum 190
Men of the Industry 191
New Equipment Available 192

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable Address: MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C. Number of copies printed in this issue, 12,600.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

A COMPOUND FOR EVERY PURPOSE

KNOW THEM...SPECIFY THEM

AMERICORE—National Electric Code Standard.

AMPARAK—Intermediate Performance Test.

AMERITE—30% Performance Test. Meets A.S.T.M. spec. D27-31T-AO.

AMPEROX—35% Super Aging compound with highest Oxygen Bomb Tests.

AMERZONE—Corona proof—Ozoneproof.

AMARINE—40% Submarine compound—Used without lead.

AMERCLAD—"Tire" stock for jackets of portable cords, and drag cables.

1831

1933

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Bldg., New York
First National Bank Bldg., Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

August 5, 1933

Manufacturers Revise Wage-Week Plan

UNDER a modified presidential re-employment agreement a number of American industry groups, including electrical manufacturing, will proceed to early re-employment action. No executive approval has been given for several weeks to any of the industry codes in the President's hands for consideration. Early approvals are said to be unlikely. By the substitute arrangement agreed upon by electrical manufacturing and administration representatives that branch of the electrical industry will embrace 36 hours as a maximum work week with a minimum of 40 cents an hour for processing labor. Other workers will receive a minimum of $15 for a 40-hour work week. Men on commission will be exempt from these provisions.

Members of the board of trustees of the Edison Electric Institute met this week to discuss the general principles for possible codification of the electric light and power industry under NRA. It is planned that all utilities, electric, gas, water, transportation and communication, involving about 1,000,000 workers, organize under a single code rather than by groups or under the NRA blanket code.

Other branches of the electrical industry, wholesalers, contractors, wood pole producers, etc., are either working on the preparation of codes or will submit preliminary drafts shortly.

Hartford Utility Offers Prompt Tenant Relief

Confronted with the plea of the Hartford City Property Owners' Protective League that the Hartford Electric Light Company should take steps to reduce rates, Samuel Ferguson, president of the Hartford Electric Light Company, promptly replied, in part, as follows:

"It developed at your meeting that the present situation, particularly hall lighting, caused a hardship to those tenants in tenements partially rented by making rent paying harder. The company wishes to be helpful and finds from an examination of specific accounts that it can relieve the situation in the following ways:

"By advice to customers as to the best choice of rate and as to the kind of lamps most advisable for this use.

"By a reduction in the rate most frequently applicable. This change has been made and the new rate has been filed with the Public Utilities Commission, effective August 1, 1933.

"Concerning above, we shall be glad to advise with each customer who will call and discuss this particular account. In some instances it may be found he is not using the best available rates for his conditions. Also, it may be found that through ignorance or accident the owner is supplying an unnecessary amount of light.

"Hitherto the smallest demand charge on rate most used for hall lighting was $1. This covered a load of 286 watts, which is more than is necessary in many cases.

"We have removed this minimum limit; this in the future will allow owners to operate with such lower demand charge as requirements of the municipal ordinance will permit.

"A monthly minimum of $1 for the total bill has been substituted. This change will reduce all bills previously affected by the minimum demand charge, of which there are hundreds of cases. . . .

"We feel that a frank discussion will prevent needless misunderstandings. We may not always be able to give the desired relief from some particular condition, but if not, it is surely up to us to give a reasonable explanation for such inability . . ."

▼

Los Angeles Contract for Steel Towers Awarded

To Tower Builders, Inc., and the McClintic-Marshall Corporation have gone the contracts of the Board of Water and Power Commissioners for the steel towers for the 275-kv. Boulder Dam transmission line. The total of the bids by the two companies was $2,289,825.

Tower Builders, Inc., is a firm made up of Consolidated Steel Corporation, Western Pipe & Steel Company of California and Blaw-Knox Company. Items No. 1 and No. 2, consisting of single-circuit towers for 270 miles of desert and mountain country, were awarded to Tower Builders, Inc., for a total cost of $1,957,737 (210 miles). The McClintic-Marshall Corporation award, for item No. 3, was for $332,088 (60 miles), covering double-circuit towers to run from Los Angeles to a point connecting with the single-circuit tower system.

A total of 2,804 towers involving 28,000 tons of steel comprised the two orders placed by the bureau. As in the case of the conductor for the line (ELECTRICAL WORLD, June 17, page 777) all steel will be fabricated in southern California. This was a factor in the placing of the business. Contracts for the insulators to be used on the line have not yet been let.

Public Works Program Advances

Roosevelt approves $63,000,000 for 450,000 hp. Columbia River project.
Cove Creek dam to be named for Norris?
Tennessee Valley Objectives defined by A. E. Morgan

REVERSING an earlier stand, the Administration has, by approval of President Roosevelt, indicated its intention to proceed with the development of the Grand Coulee project on the Columbia River with federal funds. Original plans for the Grand Coulee development called for a dam 300 ft. high to produce 1,000,000 hp. Since there is no ready market in the region for so much electricity, the government decided to build a $63,000,000 dam only 130 ft. high, but with foundations sufficient to support a structure 300 ft. in height. This will involve 450,000 hp.

The electricity that will be manufactured there, the President said, would be the cheapest in the country and would set a precedent for prices on the West Coast. The Power District of the State of Oregon will co-operate with the government in the sale of power at the dam.

The Grand Coulee Dam is what is known as a 70-30 project. The government grants 30 per cent of the cost and lends the state the remaining 70 per cent. This is to be paid back from the sale of power and water within the useful life of the dam.

No St. Lawrence reservations

President Roosevelt has declined to set aside $150,000,000 of the public works fund for the St. Lawrence seaway. He decided that it was not the spirit of the industrial recovery act to hold up the money for future work, but to use it without delay to stimulate employment. Senator Vandenberg and others who favor the St. Lawrence project urged the President to hold up enough of the emergency appropriation to begin work as soon as the treaty is ratified by the Senate.

It has been announced by the Tennessee Valley Authority that "In recognition of his long and successful fight for government control of the power resources of the Tennessee River system" the proposed dam at Cove Creek will be named in honor of Senator Norris. Immediate preparation of preliminary plans for the 220-mile tie transmission line to link Wilson Dam at Muscle Shoals and Norris Dam at Cove Creek has been ordered.

Cities seek Shoals energy

About 25 tentative applications for electric power from Muscle Shoals and the Cove Creek project have been received by the Tennessee Valley Authority from municipalities in Alabama, Kentucky, Mississippi, and Tennessee.

Some of these places have municipal plants while others are served now by private companies, and several have no electric service whatever.

There are two avenues open for the Authority to afford power service. The first is to bargain with existing private lines for service on a rate schedule to be established. The second is to build its own lines, serving groups of municipalities in the order of their application in so far as possible.

Recent visits of David E. Lilienthal to Memphis, Tenn., and Florence, Ala., indicate the interest of the Tennessee Valley Authority in outlets for federal-plant energy.

Mr. Lilienthal urged Memphis City attorney Walter Chandler to marshal facts and to present the case to the city of Memphis at the earliest possible date. This will determine whether Shoals power can be profitably sent this far or whether its distribution will be restricted to the immediate area around the Shoals.

"Mr. Lilienthal particularly desired to know the franchise limits of the Memphis Power & Light Company, and whether the city of Memphis had the legal authority to buy the company's distribution system or to develop a distribution system of its own," Mr. Chandler said after his conference with the Valley Authority member.

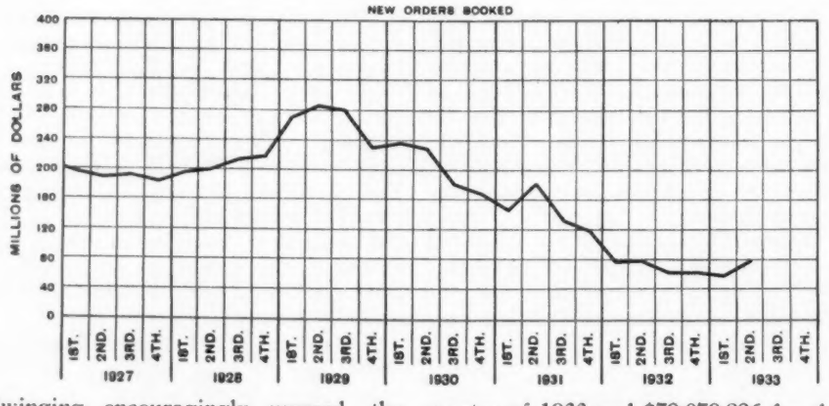
A. E. Morgan defines purposes

Speaking upon the general program of the Tennessee Valley Authority, Chairman Morgan stated late last week:

"The most important point to be understood is this: The Tennessee Valley Authority is not primarily an emergency unemployment relief measure. In its various programs the United States government has provided about five billion dollars to overcome the depression. A considerable proportion of this sum is to be spent in the Tennessee Valley by various other agencies of the government. Only 1 per cent, roughly speaking, was allocated to the Tennessee Valley Authority. The money should be used as far as consistent to relieve unemployment. But that is not the main purpose. The main purpose is to make the business and social life of the farms and the small towns permanently prosperous, to get the help of the young people in training competent folk to carry on the small industries, and to add to the capacities of the old and young to enjoy their lives where they were born. It is a pioneer job, requiring the pioneer spirit and the pioneer patriotism of those who originally peopled the valley almost two hundred years ago. The historic origin of the people, and their sturdy, independence of character, as well as the great natural wealth of the valley, and its ideal geographical relation to the rest of the continent, led the nation to place the responsibility for the success of this undertaking on the Americans of the Tennessee River basin."

▼

Electrical Manufacturing Shows Gains



Swinging encouragingly upward, the reports on new orders booked during the second quarter of 1933, as recorded by the Bureau of the Census from the activities of 78 manufacturers of electrical goods, show $79,513,557, as compared with $57,897,333 for the first quarter of 1933 and $79,079,886 for the second quarter of 1932. The totals include motors, storage batteries, domestic appliances and industrial equipment and are offered, not as a complete statement of the industry, but as sufficiently representative to indicate the trend.

▼

Alabama Competition Dropped

Long-discussed plans of the Alabama Fuel & Iron Company to build transmission lines and sell electrical energy to employees as well as others has been given up, according to an announcement by Charles D. DeBardleben, president. This decision was made after the Alabama Power Company obtained an injunction to prevent such a plan unless

the mining company obtained a certificate of convenience and necessity from the state Public Service Commission. The power company proved its ability to supply ample power and light to the company and its employees.

▼

June Energy Output Up 10 per cent, Survey Reports

Output of electric public utility plants in June surpassed that of every other month since March, 1932, and exceeded that of June a year ago by 10 per cent. Production amounted to 7,207,436,000 kw.-hr., according to the U.S. Geological Survey. This makes the average daily production 240,200,000 kw.-hr., nearly 6.5 per cent greater than in May. The percentage increase is the greatest ever recorded for consecutive months. The normal change from May to June is an increase of about 1.5 per cent.

Average daily production by the use of water power decreased from May, because of the usual diminution in stream flow. The increased demand was supplied by fuel-burning plants. Water power production remains, however, about 12 per cent greater than a year ago and still constitutes 42 per cent of the total. The amounts in the accompanying table refer not alone to plants for electric light and power, but to all plants supplying energy for public use.

Comparative Output of Public Utility Plants

Millions of Kw.-Hr.

	1932	1933	Year's Increase Per Cent
January	7,567	6,932	— 8
February	7,023	6,285	— 8*
March	7,323	6,674	— 9
April	6,790	6,462	— 5
May	6,650	6,996	+ 5
June	6,563	7,207	+10

*Based on average daily production

Regional Increase Compared With 1932, Per Cent

Region	May	June	Region	May	June
United States	+ 5	+10	So. Atlantic	+16	+24
New England	+12	+19	E. So. Central	+ 3	+22
Mid. Atlantic	+ 5	+ 7	W. So. Central	+ 9	+ 7
E. No. Central	+ 4	+11	Mountain	+ 3	+11
W. No. Central	+ 4	+ 6	Pacific	— 4	— 1

▼

Cedar Association Code

Adoption of a code of fair competition for the cedar pole and allied products industry prepared by a special committee of the Consolidated Western Red Cedar Association and Northern White Cedar Association has been announced. This code, subject to the customary trimming and rewording under the Washington activities, under the protective guidance of a temporary national emergency committee, will establish a program for NRA co-operation.

A Farewell to Inflation?

Coincidence or no coincidence, just at the time that a federal $500,000,000 eight-year public loan was to be floated at 3¼ per cent, just when bankers announced their willingness to aid commercial activities with an expanded financial policy and just as the Reconstruction Finance Corporation expressed its willingness to extend its resources up to $50,000,000 in purchases of the preferred stock of any sound bank came somewhat guarded assurances that inflation of the currency was to be relegated to the less immediate hazards of existence.

Nothing could be more encouraging. Currency inflation has been the fear-mechanism which, natural though some aspects of the recovery may be, has led to the unprecedentedly rapid upsweep in the stock and commodity markets and in some industries. It is not impossible, even with the fear removed, with higher costs to industry introduced under NRA and with purchasing power restrained by price rises, but increased by wage improvements, that trade volumes can be maintained. Undoubtedly currency inflation will again be brought to the fore should difficulties arise in the present program. It is the big stick behind the whole endeavor.

Facts of the week: Security and commodity markets uneasy, dominated by the crash of the speculative bubble in wheat; cotton declines $2.50 a bale; shipments of cotton to mills falls from 150,000 bales to 101,000 bales in one week; carloadings for the week of July 22 the heaviest of the year and the largest of any week since late 1931; automobile production counter-seasonally rises to the highest point since late 1930; lumber production falls off after reaching the highest point since mid-1931; bituminous coal output rising sharply; general business indexes fall off; energy production shows sustained strength.

Westinghouse Loss Lower; $14,138 Earned in June

For the second quarter of 1933 the Westinghouse Electric & Manufacturing Company reports a net loss of $2,078,424, the smallest net loss for any quarter since the second one of 1932, when the loss was $1,881,979. Net loss in the first quarter of 1933 amounted to $3,491,572. There was a net income of $14,138 in June. Orders received by the company in the second quarter totaled $17,557,964, comparing with $20,343,216 in the corresponding quarter last year.

Sales billed for the quarter ended June 30 totaled $15,926,335, as compared with $21,014,769 for the similar period of 1932.

Commenting on the report, F. A. Merrick, president, said: "While our bookings and net sales billed are showing an appreciable improvement they are now only approximately 30 per cent of the 1929 and 1930 level. The losses have been held to their present rate at the existing volume of business as the result of extensive expense reductions . . . Overhead expenses, exclusive of depreciation, taxes and insurance, which are in large measure irreducible, have been reduced approximately 60 per cent from the level of 1929 and 1930. Naturally, a portion of this expense reduction has been possible only because of the generally depressed state of business, but a large portion of the results, obtained through simplification of organization, will carry forward into the period of increased business which now seems to be opening. . . ."

New York Salary Lists Again Before Commission

Continuing its widespread search for pertinent facts in rate reduction hearings, the New York Public Service Commission has again reverted to salary lists despite protests by utility attorneys. Earlier hearings (ELECTRICAL WORLD, July 1, page 5, and July 8, page 36) covered metropolitan companies.

At hearings last week evidence was presented to show that George B. Cortelyou as president of Consolidated Gas Company received $100,000 a year up to May 1, when, in the general reduction then made effective, it became $91,666.57. Floyd Carlisle, as chairman of the board of Consolidated, received per year, $25,000 in 1932, $22,916 in 1933. Other Consolidated Gas Company salaries, ranging down from $50,000 to Walter R. Addicks and $32,083 to Henry M. Brundage, were made public.

Refused access to the minutes of the last three meetings of directors of the Niagara Hudson corporation, the New York Public Service Commission retaliated by publishing the organization's salary lists. P. A. Schoellkopf, chairman of the board of the Buffalo, Niagara & Eastern Power Company, draws $44,226 this year, as against $50,000 last year. A. H. Schoellkopf, president, received a similar reduction in his pay. Other salaries are: F. D. Corey, chairman of the executive committee, $26,586, as against $30,000 last year. William Kelly, vice-president and general manager, $34,406, against $40,000 last year.

Salaries paid to the officials of the New York Power & Light Corporation are: Otto Snyder, president, $22,176. John L. Haley, vice-president, $14,238.

Officials of the Syracuse Lighting Company received: James C. Delong, $9,000. A. Dean Dudley, $11,592. G. H. Garrison, $14,000. J. M. Costello, $9,676.

Coming Meetings

Economic Conference for Engineers—Johnsonburg, N. J., August 12-20. H. N. Davis, Stevens Institute of Technology, Hoboken, N. J.

National Electrical Wholesalers Association—Buffalo, N. Y., August 14-19. E. Donald Tolles, 165 Broadway, New York.

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

Rocky Mountain Electric Association—Santa Fe, N. M., September 11-13. George E. Lewis, Gas and Electric Bldg., Denver, Colo.

International Association of Electrical Inspectors—Chicago, Ill., September 11-14, V. H. Tousley, 612 No. Michigan Avenue, Chicago.

National Electrical Exposition — New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

▼

Bonner Winning Suits Over Hearst Editorials

Memories of United States Senate controversies in 1930 over Messrs. Bonner, Russell and King, of the Federal Power Commission, are refreshed by reports of recent court decisions which F. E. Bonner, one-time executive secretary of the commission, is winning in various cities. Mr. Bonner, accused by the Senate of favoritism to power company interests, resigned when a new commission was sworn in. Messrs. Russell and King were dropped, though radical senators protested loudly.

Libel suits entered by Mr. Bonner against Hearst papers in fourteen cities, asking from $100,000 to $1,000,000 damages for allegedly libelous statements in syndicated attacks, have been settled in two instances. A Boston jury decision awarded $50,000 to the plaintiff five months ago. A Washington decision recently brought him $45,000. Action on a Los Angeles suit is scheduled for September.

▼

New Georgia Commission Prepares for Rate Action

That any semblance of peace and quiet could descend upon the sovereign state of Georgia through the ousting of the old Public Service Commission and the institution of a new one has been quite disproved by the ensuing events.

Quo warranto proceedings have been filed against new members by James A. Perry, former chairman, and Albert Woodruff, member of the commission.

Curtess B. Mees, whose testimony was heard on behalf of the prosecution at the ouster proceedings, has been sought as rate expert. His appointment has not yet been announced.

Immediate action toward the securing of lower electric utility rates throughout all Georgia is freely discussed. Ousted Commissioner Jule W. Felton has stated: "The Governor, in his overzealous effort to reduce utility rates, or make it appear that he is trying to do so, has tied the hands" of the new commission because "if his own statement is true he ascertained from each appointee that he would positively reduce utility rates before he would appoint him. It is obvious that each appointee agreed to the Governor's will before he accepted the appointment. Therefore, each member of the commission is now disqualified to pass on a rate case for the obvious reason that he has prejudiced each rate case before a hearing has been had."

"My Sunday statement was written Friday night. My charge that the hearing was a farce and that the Governor had prepared the case has been confirmed by the Governor's admission that that was true. He set out to make it appear that he has fulfilled his campaign pledges and he says that he has performed the last one by firing the commission. A wayfaring man, though a fool, understands what that means."

▼

Associated Plan Still Opposed

Unconvinced, in spite of the fact "we have given the plan careful consideration, have examined the information in connection with it which has been made available to us by the company and have discussed it with holders of large amounts of debentures and with investment banking houses which have been associated with us from time to time in the past in the distribution of the debentures," Chase Harris Forbes Corporation still concludes, "all circum-

▼ ▼ ▼

Current Earnings Reports of Electric Light and Power Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Operating Companies					
Detroit Edison (Year ended June 30)					
Gross earnings	$41,363,782	$46,515,514	—11.1	71	68
Net earnings	12,029,890	14,961,353	—19.6	..	..
Net balance	5,572,762	8,936,383	—37.6	..	..
Duquesne Light (Year ended May 31)					
Gross earnings	23,930,695	26,793,090	—10.7	43	42
Net earnings	13,532,932	15,453,452	—12.5	..	..
Net balance*	10,995,570	13,198,426	—16.7	..	..
Louisville Gas & Electric (Year ended May 31)					
Gross earnings	9,670,777	10,229,359	— 5.5	57	55
Net earnings	4,148,436	4,633,718	—10.5	..	..
Net balance	2,868,584	3,362,498	—14.7	..	..
Metropolitan Edison (Year ended March 31)					
Gross earnings	15,614,588	16,862,648	— 7.4	62	62
Net earnings	5,888,670	6,374,499	— 7.6	..	..
Net balance	1,125,789	1,350,735	—16.6	..	..
Northern States Power (Minn.) (Year ended June 30)					
Gross earnings	27,344,636	29,422,784	— 7.0	63	60
Net earnings	10,085,005	11,910,704	—15.3	..	..
Net balance	6,576,715	8,471,246	—22.3	..	..
Philadelphia Electric (Six mos. ended June 30)					
Gross earnings†	30,907,296	33,390,781‡	— 7.5	50	52
Net earnings	15,430,030	16,029,975‡	— 3.7	..	..
Net balance	10,176,668	10,669,496‡	— 4.6	..	..
Holding Companies					
American Water Works & Electric and subsidiaries (Year ended June 30)					
Gross earnings	$42,025,476	$47,013,932	—10.6	..	..
Net balance	1,869,720	4,227,447	—55.5	..	..
Associated Gas & Electric and subsidiaries (Year ended May 31)					
Gross earnings	$94,916,575	$103,155,573	— 8.0	67	65
Net balance*	31,841,469	36,425,507	—13.0	..	..
Commonwealth & Southern and subsidiaries (Year ended June 30)					
Gross earnings	108,674,023	122,805,565	—11.6	55	53
Net balance	275,335	9,615,860	—97.0	..	..
Continental Gas & Electric and subsidiaries (Year ended May 31)					
Gross earnings	30,130,283	30,004,706	0.4	65	64
Net balance	1,362,829	2,992,299	—54.3	..	..
Electric Bond & Share (Year ended June 30)					
Gross earnings¶	15,383,507	23,821,214	—35.4	..	..
Net balance	2,548,452	9,131,776	—71.9	..	..
North American and subsidiaries (Year ended June 30)					
Gross earnings	155,358,265	173,704,601	—10.6	44	42
Net earnings	11,199,902	19,557,331	—42.7	..	..
Philadelphia Company and subsidiaries (Year ended May 31)					
Gross earnings	45,750,845	53,606,180	—14.6	65	62
Net balance*	7,174,424	11,572,116	—38.1	..	..
Public Service Corporation of N. J. and subsidiaries (Year ended June 30)					
Gross earnings	119,148,492	133,366,315	—10.7	65	66
Net balance*	26,602,058	30,149,237	—11.8	..	..

*Available for all dividends. †Includes non-operating revenue. ‡Figures adjusted for comparative purposes. ¶Includes stock dividends received of $406,110 for 12 mos. ended June 30, 1933 and $684,291 for 12 mos. ended June 30, 1932.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

stances considered, that there is not sufficient incentive from the standpoint of a debenture holder to warrant making a voluntary change in his present position." Associated Gas & Electric Company's reorganization plan (ELECTRICAL WORLD, July 8, page 41) is still under consideration.

▼

California Legislature Passes $170,000,000 Act

Bringing to a climax the discussions and investigations of years the California Legislature has passed a $170,000,000 revenue bond financing act providing for initial construction on the statewide water conservation program. Passage of the act permits the project to be included in the federal public works program.

Primary purpose of the project is the construction of a high dam at Kennett on the Sacramento River for storage and power development and the transfer of water from the Sacramento watershed through a system of canals, conduits and pumping plants into the arid sections of the San Joaquin Valley, where a water shortage now exists.

Whether or not the project could be financed entirely from power revenues has been a point of issue for years. The act as finally passed included an amendment appropriating $10,000,000 for the construction of a high-tension power line from the dam to Antioch on San Francisco Bay so as to permit wholesaling of power to municipalities throughout the Sacramento Valley.

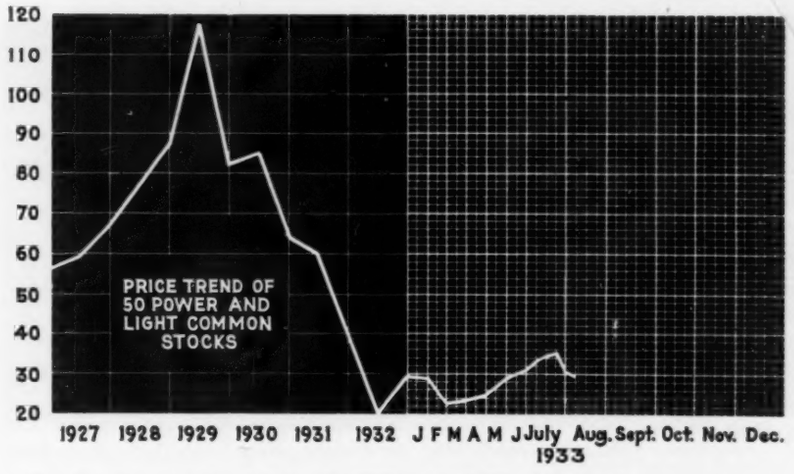
▼

Doherty Halts Sale of Cities Service Securities

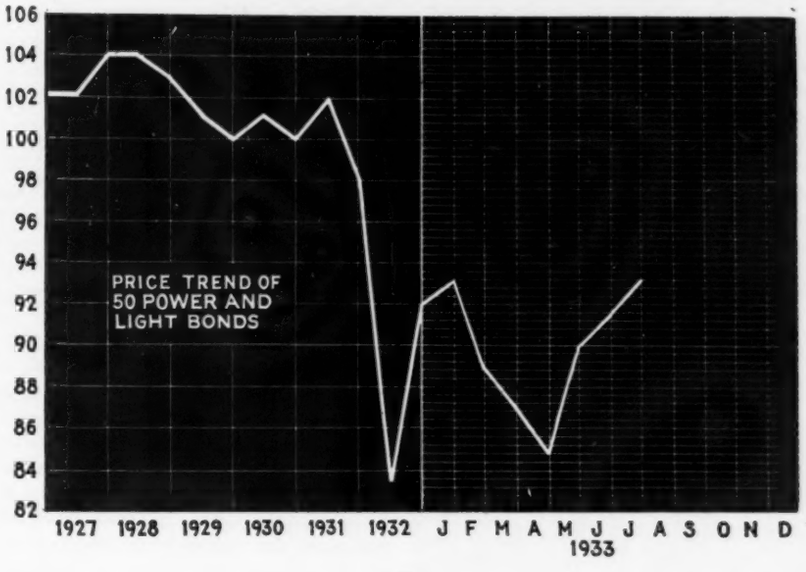
Henry L. Doherty & Co. on the day that the new Federal Securities Act went into effect (July 26) announced its withdrawal from sale directly to the public of the securities of Cities Service Company and its subsidiaries. Officials of the company said the decision to do so had been made in compliance with what they interpreted as the intent and spirit of the Securities Act: "That the sale of securities to the public should be handled by those engaged in that single line of activity, with no interest in the issuing company which might influence their recommendations."

In the future, securities of Cities Service will be handled by an independent company to be organized by former employees of Henry L. Doherty & Co. The latter organization will continue to handle securities in companies with which it has no connection.

Utility Bonds Up; Stocks Down



During the month of July the "Electrical World" bond average rose from 91.4 to 93.4, highest since January. Stock fluctuations of the week were downward; average last week 30.4 (corrected); this week, 28.9.



▼

Midland United Companies Would Merge for Service

Purchase of the Hobart Light & Water Company of Hobart, Ind., by the Northern Indiana Public Service Company has been sought in a joint petition filed with the Indiana Public Service Commission by the two concerns.

The purchase price, of which commission approval is asked, would be $738,270, to be paid by the assignment to the selling company of 73,827 shares of no-par value common stock of the Northern Indiana Public Service Company at $10 a share.

The joint petition sets out that the Hobart company does not have the facilities "for furnishing an uninterrupted supply of electrical energy to its customers that are possessed by the purchasing petitioner" and that the acquisition of the property is desirable from the standpoint of public interest.

▼

Few Utility Defaults

But two electric light and power issues appear in the listing of July bond defaults compiled by Dow, Jones & Company: Lexington Water Power 1st 5s defaulted to the amount of $12,000; North American Gas & Electric debenture 6s to the amount of $2,000,000. Utility issues in default totaled $38,916,190 in July; railroads, $10,464,300; industrials, $19,001,400, and real estate, $43,110,500. Total July defaults $111,492,390.

Rise Continues, Though Slower

Central-station output during the week ended July 29 rose to the maximum for the year, amounting to 1,661,504,000 kw.-hr., according to the Edison Electric Institute. The rise of about 7,000,000 kw.-hr. over the preceding week ran parallel with a similar rise a year ago so that the excess over 1932 remains at 15.4 per cent.

Thus the deficiency compared with the most nearly corresponding week of 1930 has been cut to 1 per cent and compared with 1929 to 3.7 per cent. The upward trend continues though at a slower rate than during May and June. New England continues to lead in the recovery, with the Central industrial area a close second.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
July 29.....	1,662	1,440	1,644	1,678
July 22.....	1,654	1,434	1,651	1,686
July 15.....	1,648	1,416	1,645	1,667
July 8.....	1,539	1,342	1,604	1,626
July 1.....	1,656	1,457	*1,607	*1,594

*Includes July 4 holiday.

Per Cent Change from Previous Year

Region	Week Ended July 29	July 22	July 15
New England.....	+24.0	+27.1	+26.0
Middle Atlantic....	+13.6	+11.7	+12.2
Central industrial..	+21.1	+19.2	+19.2
Southern States....	+14.0	+18.6	+25.8
Pacific Coast.....	+ 8.0	+ 8.0	+ 5.3
United States.....	+15.4	+15.4	+16.4

▼

Conditioned Air Halts Hay Fever

Air conditioning promises relief for the hundreds of thousands of persons to whom summer means hay fever and asthma, according to experiments conducted jointly by the Johns Hopkins Hospital, Baltimore, and the Frigidaire division of the General Motors Company. A ward room at the hospital is equipped with a cabinet that clears the air of pollen and dust, keeps the temperature 10 deg. below outside temperature and reduces the humidity. When persons suffering from hay fever uncomplicated by asthma were admitted to this ward "a striking change was noted in ten to fifteen minutes," reported Dr. Leslie N. Gay of the hospital staff before the Society for the Study of Hay Fever and Asthma. "Within an hour the symptoms had entirely subsided and after two hours the individuals, who had been most miserable, had no evidence of hay fever. These patients were then returned to rooms without artificially conditioned air. Within fifteen minutes symptoms developed and in an hour they were as miserable as before treatment."

Patients suffering with hay fever combined with pollen asthma did not respond quite so rapidly, although "within one hour there was striking improvement in their general condition," declared Dr. Gay. "The patients who had pollen asthma suffered for the first fifteen hours with moderate wheezing; however, the symptons were quite mild compared with the hours of discomfort previous to admission to the air-conditioned atmosphere. After 36 hours the patients slept comfortably throughout the night, and although coughing occurred occasionally, the result of this measure was most satisfactory."

▼

Swiss Plan High Head Plant

Combined efforts and activities of the Swiss Federal Railways and the North-East Switzerland Electricity Supply Company are to be directed toward the building of a new hydro-electric plant to be known as the Etzel and to utilize the power of the River Sihl near Einsiedeln, 2,886 feet above sea level. The power house will be located at an altitude of 1,342 ft., the total head available being about 1,544 ft. The first stage of development is to comprise six vertical shaft generating sets of 20,000 hp. rated output. A second stage is to increase their number from six to eight. The first six turbines are all to be identical and of the Pelton type having two nozzles.

▼

Battersea Gas Washing Costs and Layout Told

At the 52d annual meeting of the British Society of Chemical Industry engineers active in the researches which preceded the installation of the revolutionary flue-gas-cleansing equipment at the Battersea station of the London (England) Power Company as well as those handling the operation of the plant reported upon results and costs.

At Battersea gas from coal containing about 1 per cent of sulphur is washed with water during its passage through scrubbers in which both the gas and water are brought into contact with iron oxide. The gas is then scrubbed, preferably in contra-flow, with water in another chamber, the scrubbers being made of an inert material such as wood. After passing upward through water sprays, the gas enters a final scrubber which is wetted with an alkaline solution, for example, 0.25 per cent chalk slurry.

The gas is then discharged to the atmosphere after passing through a dry scrubber to remove entrained moisture. The alkaline solution flows downward and mingles with the water from the water sprays. If the gas were at normal temperature and pressure and the washer quite empty the gas would take about 30 to 35 seconds to pass through the washer. About 20 tons of water and 10-12 lb. of lime or chalk are used per ton of coal burned, at a cost, for pumping and alkali, of about 3d. per ton of coal. In this way about 90 per cent of the oxides of sulphur can be removed from gas derived from coal containing 0.8 to 1.0 per cent sulphur. Entrained air bubbles are produced in the wash water supplied to the steel filling by brisk aeration and the effluent from the whole plant is also aerated to oxidize sulphites.

The total reducing power of the effluent may thus be made equivalent to as little as 3 gns. of sulphur per gal. in the form of sulphite. A very small amount of manganese in solution will promote oxidation still further. After filtration the effiuent is diluted with about 25 times its bulk of return condensing water which is sufficiently alkaline to neutralize the acidity of the effluent.

The net cost of the Battersea flue-gas-cleansing installation was £246,400. The total weight of flue gas cleaned is approximately 3,600,000 lb. per hour or, roughly, 1,500,000 cu.ft. per minute. The initial concentration of sulphur dioxide in the gas lies between 0.02 and 0.05 per cent by volume and it is possible to reduce this by about 90 to 95 per cent.

San Francisco Code Sets High Standards

Requiring a number of standards higher than those of the National Electrical Code, a new electrical ordinance for the city and county of San Francisco has been adopted after months of conference between interested parties and Ralph W. Wiley, chief of the San Francisco Department of Electricity.

Some of the additional requirements or exceptions to the national code are as follows: Electric metallic tubing is not permitted for services. No service conduit may be less than 1¼ in. Multiple-conductor service cable is allowed, but conductors must not be smaller than No. 4. Such cable is not permitted for any use except services. Bare neutral service is permitted. Main service switches and fuses may be omitted where the required switch size exceeds 1,200 amp. and the length of unprotected bus does not exceed 25 lin.ft.

On residential work knob and tube wiring is permitted, although armored cable, non-metallic sheathed cable and wooden molding are not. Rigid conduit is to be used on all new work except dwellings and flats. Flexible conduit can be used except for services, or in new work, or for grounding conductors. Armored cable can only be used on special permission.

Black enameled pipe out

Long desired by part of the industry, a daring step is taken in requiring that no black enameled pipe may be used; all conduit must be galvanized, sherardized or hot-dip galvanized. A six months period to clean out present conduit stocks is granted. Electric metallic tubing is permitted for 600-volt, four-wire circuits. Non-metallic surface extensions are not permitted. Conductors are required to be covered with flame-retarding, moisture-resisting braid.

Meter sequence is determined as switch, meter and fuses; in special cases, meter, switch and fuses.

Panelboards are limited to 40 circuits, single fusing; 20, double fusing. Appliances of 1,500 watts or more must be switched or provided with approved plug; metal frames must be grounded. Three-wire circuits are not permitted unless in a complete single-fused, identified-neutral installation with voltage not exceeding 150, and then only for either a lighting or a convenience outlet circuit, but not mixed. The same provision holds for multi-phase circuits.

Domestic circuits are limited to twelve outlets, or 25 medium base sockets or not more than 1,000 watts to the circuit. Stores are permitted 1,500-watt circuits; industrials, 4,000-watt circuits with special permission. For lighting stores must provide a minimum of 2 watts per sq.ft., industrials, 1 watt. Convenience outlets are to be wired on separate circuits with no wire smaller than No. 12 and fused at 20 amp., 125 volts. In domestic circuits eight single or duplex outlets may be installed; in stores only six single or three duplex outlets. A new schedule of demands for fixed appliance loads is listed.

▼

Lake of Ozarks Park Backed by Utility

Union Electric Land & Development Company, land-owning subsidiary of the Union Electric Light & Power Company of St. Louis, Mo., has submitted to the public works committee of the Missouri Relief and Reconstruction Commission recommendations for the establishment of state parks and parkways in the vicinity of the Lake of Ozarks and leading to that recreational resort from St. Louis and Kansas City.

Estimated initial cost is $4,095,000, including $1,000,000 for development of three state parks, $1,747,000 for scenic parkways around the lake and $1,350,000 for four bridges across the lake.

The report of the engineers assumes the Union Electric Land & Development Company to be willing to cooperate with the state in setting up the areas for the state parks and shore acquisition and protection and that most of the rights-of-way for the parkways would be donated.

Lake of the Ozarks was formed by water backed up by the Bagnell Dam of the Union Electric Light & Power Company on the Osage River. The Union Electric Land & Development Company owns much land in the vicinity of the lake.

▼

Midget Load Building a Successful Plan

Reporting upon the success of its Midget Plan for the installation of small electric heaters where they are particularly suitable and their use advantageous, General Electric reports that as the second year starts 118 power companies are engaged in midget load-building; each utilizes an average of two men to promote heating load—total, 236 men; 79 companies are using a total of 160 sample kits—an average of two per company; 76 companies are distributing 500,000 pieces of heating literature to 25,000 industrials; 40 companies reported, for the last quarter in 1932, new heating kilowatts at the rate of 450 per year per company, and 24 companies, reporting for the first quarter of 1933, are adding midget load at the rate of 560 kw. per year per company.

Progress in the sale of the midget heaters shows: 1931, 66,000 kw.; 1932, 58,000 kw., and for the first five months of 1933, 37,500 kw. This is at the rate of 90,000 kw. per year, or 55 per cent increase over 1932.

Major New Construction This Week

Department of Commerce, Division of Aeronautics, Washington, D. C., has $108,000 for relocating airways lighting system from Omaha to Chicago and $50,000 for similar program between New York and Boston.

Motors, air compressors, pumps, etc., will be purchased by Gregg-Tex Gasoline Corporation, Longview, Tex., at estimated cost of $200,000.

Transformers, electric furnace and motors will be installed by Phelps Dodge Copper Products Corporation, Elizabeth, N. J. Cost about $200,000.

German-American Brewing Company, Buffalo, N. Y., plans $600,000 plant with power house and electric refrigerating division.

East Point, Ga., has called special election August 22 to approve bonds for $140,000 city-owned electric light and power plant. Bids will soon be asked.

Bavarian Brewing Company has approved plans for $340,000 addition to Covington, Ky., brewery.

Motors, controls, pumps, conveyors, etc., will be installed in $200,000 addition to industrial alcohol plant of Commercial Solvents Corporation, Terre Haute, Ind.

At an estimated cost of over $600,000, with machinery, Columbus, Ohio, plans expansion and improvements in city-owned electric light and power plant.

▼

Refrigerator Quotas Fall; Six-Month Sales 666,750

Setting a new high record for the month of June, exceeding the National sales quota by 29.8 per cent and establishing a six-month record, refrigerator sales, as reported by the Edison Electric Institute, continue to deny depression influences. Sales for June were 213,420 units, compared with 212,770 in May, the previous record month, and 151,774 in June, 1932.

Sales in the first six months were 666,750 units, compared with 589,955 in the like period last year. In the record year, 1931, when the year's unit sales approximated 965,000, sales for the first six months were 597,454 units.

The six-month total is 129.8 per cent of the quota of 513,389 set for the period by the bureau in its promotional campaign to sell 800,000 units in 1933.

▼

New York Metal Prices

	July 25, 1933 Cents per Pound	Aug. 1, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.50	7.75
Nickel ingot	35.00	35.00
Zinc, spot	5.35	5.35
Tin, Straits	45.875	44.75
Aluminum, 99 per cent	23.30	23.30

As to Rates—

• Twenty-seven public utility companies in ILLINOIS were recently notified by the Illinois Commerce Commission that they would have to bear the expense of surveys and investigations made by the commission since July 10 in an effort to discover whether or not rates should be reduced. Notification follows the passage of new Commerce Commission acts giving the commission increased powers over the utility companies. One of the amendments permits the commission to charge a utility the expenses of a rate investigation up to a maximum of one-half of 1 per cent of the gross operating revenue involved.

• MISSOURI Public Service Commission issued an order last week granting authority to Union Electric Light & Power Company to reduce rates for street lighting in St. Louis County 3.8 per cent. The reduction will be effective August I and will apply to urban, suburban and rural territory in the county. If such customers make a renewal contract for existing lighting facilities they will be given an additional decrease of 17.4 per cent, a total ultimate reduction for this class of lighting in St. Louis County of $18,650 from the present lighting cost.

• Maintaining that the revenues of the company do not justify any reduction and expressing the belief that rising costs and increased government taxes will make it more difficult for the company to conduct business at a reasonable profit, the MASSACHUSETTS Department of Public Utilities has sustained the rates charged by the Amesbury Electric Light Company.

• MASSACHUSETTS Public Utilities Commission has been requested by Charles V. Ryan, Springfield city solicitor, to reverse a position taken by it in several past cases—that a 6 per cent return was fair and equitable under the so-called Massachusetts theory of rate regulation on the basis of capital honestly and prudently invested—and permit both the United Electric Light Company and the Springfield Gas Light Company to earn a return of less than that percentage. City Solicitor Ryan appeared in support of Mayor Dwight R. Winter's petitions for a reduction in both electric and gas rates. The solicitor asserted that the gas company has earned a return of 6½ per cent, while last year, in its poorest year, the United Electric earned 8½ per cent. He held that although the commission has taken the position that a return of 6 per cent was fair, "in these times utilities could be allowed a return of less than 6 per cent without it being considered confiscatory." The hearing on the electric rates was set for September 27 and 28.

• Randolph & Holbrook Power & Electric Company has been directed by the MASSACHUSETTS Department of Public Utilities to file with the department a new schedule of rates to be effective August 1. According to the decision, there are few changes in the new schedule as compared with the old one. The department also approved the petition of the Weymouth Light & Power Company and the Randolph & Holbrook Power & Electric Company for the consolidation of the two organizations.

• Reductions in rates for electricity charged by the North Adams Gas Light Company were urged by the Mayor and certain citizens before the MASSACHUSETTS Department of Public Utilities. Efforts on the part of the City Council to get more favorable rates from the company, it was stated, had failed. Allegations were made that the company had made so much money that it and its stockholders should be satisfied with the profits even after requested reductions have been made in power and domestic rates.

• In a recent ruling the WASHINGTON State Department of Public Works held the Puget Sound Power & Light Company's wholesale power contract with the town of Waterville to be "excessively high and unjust, unfair and discriminatory, when compared to rates charged other customers for like service. The contract was ordered set aside and new rate schedules prescribed, effective as of May 1, to conform with the company's rates in various towns.

• On account of increased taxes and the prospect of further imposts on the Lawrence Gas & Electric Company no general rate reduction will be ordered at present by the MASSACHUSETTS Department of Public Utilities, which dismissed a petition against the company in a recent finding. An experimental rate reduction went into effect early last year following conferences between the board and various parties in interest. The company's return for 1932 showed a loss in net operating revenue of $140,485 and for the first five months of this year a further loss of $63,330. The commission cited the transfer of the federal 3 per cent tax from customers to the company and possible cost increases under the recovery act in its finding as reasons why no general cut can be made in rates at this time. A downward revision of rates to small power users was ordered.

Past dividends are cited in New York case

• With representatives of consumers charging that the utility companies are "stalling" to prolong hearings, the NEW YORK Public Service Commission's inquiry into electric rates in New York continued last week. An involved cross-examination was directed by Richard J. Smith, of counsel for the companies, at Windsor A. Toan, economist, who prepared for the commission charts comparing electric rates and utility corporation incomes with other costs and earnings during recent years. When counsel for the companies sought to have Mr. Toan admit that one of the charts did not give a proper comparison between utility company dividends in this city and dividends paid, on the average, by other corporations, Mr. Maltbie intervened to recall that one of the companies in the city had raised its dividend rates to the equivalent of 24 per cent a year in 1932. This was the Bronx Gas & Electric Company. The New York & Queens Electric Light & Power Company and other companies also raised their dividend rates at about the same period, Mr. Maltbie pointed out. He insisted that in the case of such companies as reduced their dividend rates in 1932, as did the New York Edison, the reduction should be judged in the light of whether the corporations added sums to their surpluses.

Objection that the hearings were being delayed was made by Robert J. Thoesen, counsel for a group of commercial users of electricity in Manhattan, and Robert A. Moore, representing Queens consumers. Counsel for the companies contended that they had a right to examine exhibits, such as the charts, before they were marked in evidence and the objections were overruled. Another witness was Franklin H. Nickerson, vice-president of the Yonkers Electric Light & Power Company, who was questioned by Colonel Blakeslee concerning the finances of his company.

At a later session numerous statistical charts purporting to show that the economic depression has lifted and that no reason exists for emergency rate reductions were offered by the electric companies. Mr. Smith contended that the present economic upturn and forecast of its continuance should be considered by the commission in any rate adjustment. On the basis of June figures, as compared with those of March, Dr. Warren M. Persons, economist and statistician, said there had been a 40 per cent increase in production of commodities and predicted a further rise would take place. Mr. Maltbie questioned the qualifications of the witness to predict the future, but Mr. Smith held that the commission should consider "a reasonable prediction." Before Mr. Persons's testimony, Leonard Kuvil, business economist of the National Industrial Conference Board, testified concerning numerous other charts. One of these purported to show that the wholesale price index of fuel and lighting had a slower increase since March than the index of other commodities.

Major Ezra B. Whitman, civil engineer of Baltimore, explained a chart showing domestic prices of electricity. With the year 1913 as a base at 100, his chart showed that from June to December last year the prices for the United

States as a whole stood at 79, while prices of domestic electricity in Manhattan, Brooklyn and Queens were 58.9. Harry R. Woodrow, vice-president of the Brooklyn Edison Company, explained exhibits showing rate of return on investment for four of the affiliated companies at 6.07 per cent for the first four months of 1933, excluding going value.

• City Council of WICHITA FALLS, TEX., with one dissenting vote, has accepted the proposition made by the Texas Electric Service Company June 30 to slash $52,000 off the annual electric rates in addition to assumption of the 3 per cent federal tax next September 1. The new rates go into effect as of July 1. Citizens will continue to pay the 3 per cent tax until September 1. The cut in rates will total $52,000 annually and the tax $13,000, making a total yearly saving for electric power consumers of $65,000.

• Complaint against the rates charged by the Washington Gas & Electric Company in MORTON, WASH., and vicinity has been filed by the Department of Public Works, charging the rates as excessive and unreasonable. A valuation survey was ordered and hearing date will be set shortly. The Interstate Power & Light Company, selling power at wholesale to the Washington Gas & Electric, has been made a party defendant.

• Compromise schedule of rates for the Birmingham Electric Company estimated to cut $360,000 annually from residential and commercial lighting bills and $40,000 from the city's street lighting bills has been approved by the ALABAMA Public Service Commission. A single schedule is set up for residential rates and effects an average saving to customers of 22 per cent, according to I. F. McDonnell, engineer for the state utility board. A previous schedule submitted by the company was rejected by the commission (ELECTRICAL WORLD, July 22, page 104).

▼

Spicer Rapids Contract Void

Because it has been established that the St. Francis River in the province of Quebec is not navigable, the Superior Court of Quebec has ruled that that part of the river bordered by the land of the St. Francis Hydro-Electric Company forms part of the property of the company, and that a lease given by the Quebec Government granting the Southern Canada Power Company the right to develop a power plant at Spicer Rapids is null and void. The Southern Canada Power Company had been granted a lease for a period of 75 years and had intended to develop a plant capable of producing 50,000 hp. The company had also planned to build a dam near Jersey Island on the river.

Municipal Items

BIRMINGHAM, ALA.—With the purpose of determining the attitude of voters on a municipal light plant a special election has been set for October 9. No bond offering is involved, the only question being the issue of whether or not the city is authorized to go into the power business. Decision of the city commission to authorize the election was made after failure to agree with the Birmingham Electric Company on a ten-year street-lighting contract. The Alabama Public Service Commission has just approved a new schedule of rates submitted by the Birmingham company (See As to Rates, this page).

SULLIVAN, ILL.—Householders received their month's electric light bills last week and found them marked "paid." Officials of the municipal light plant said it was their way of breaking the news to their patrons that the plant has $50,000 in surplus profits.

HICKMAN, KY. — Plans have been temporarily abandoned for the construction of a municipal light and power plant and water works system. Recently the city officials signed a new contract with the Kentucky Utility Company to run for two years.

NEBRASKA—Application has been made to the Nebraska Supreme Court by the city of St. Paul for the appointment of three district judges to appraise the local plant of the Central Power Company to carry out condemnation proceedings ordered instituted by a recent election. The validity of the law which authorized such proceedings is to be attacked.

Nebraska Supreme Court has enjoined the city of Ainsworth, until further action, from contracting with Fairbanks-Morse Construction Company to erect a municipal lighting plant under an agreement that title shall remain with the latter until the cost has been met from net earnings of the plant. Plaintiff in the case is the Interstate Power Company, which now serves the city, and which challenges the right of the Council, without a vote of the people, to contract for an entirely new plant on such terms. The court held two years ago that such contracts were lawful where they covered additions and betterments.

Bitter feeling was developed between the rival power and irrigation districts in Nebraska at a conference called in Omaha to carry out a suggestion of Senator Norris that a compromise be made as between conflicting interests so that whatever requests are made of the government for financial aid relate only to the most feasible projects. The tri-county project, which calls for expenditure of 45 of the 70 millions allotted to the state, was vigorously denounced by spokesmen for other sections, but a resolution demanding representation on the state committee in charge of expenditures of all listed projects was voted down.

CORAOPOLIS, PA. — Six years after the sale of its municipal light plant, which stirred a raging controversy at the time, Coraopolis Borough again is considering plans to furnish light for its own use. Since the expiration of a five-year franchise for municipal lighting with the Duquesne Light Company last September Peter Loftus, consulting engineer, has been making a survey on plans for reinstalling the borough system. His report will be made to the Borough Council August 7.

SALT LAKE CITY, UTAH—An initiative petition calling for a vote on an ordinance for the creation and operation of a municipal light and power plant has been filed with the city recorder. The Council has 30 days after August 1 in which to adopt or reject the ordinance. If adopted it goes into effect immediately; if rejected, it goes on the ballot for the November 7 city election. The ordinance provides for the issuance of $18,000,000 of revenue bonds for the purpose of acquiring or constructing a municipal light and power system, interest and principal to be paid from proceeds from the operation of the plant.

YAKIMA, WASH.—By a vote of 1,315 to 2,855, the voters of Yakima rejected the proposed franchise for the Pacific Power & Light Company, with the vote cast the largest ever recorded in a special election. The company's franchise has eighteen months to run. No further actions have been definitely planned in Yakima.

BEAUMONT, TEX.—City Manager Paul Millard has announced that approximately $600,000 in delinquent taxes will have to be collected before the street lights can be turned on. Back bills the city owes and salaries for city workers come first, according to municipal authorities.

FORT WORTH, TEX.—City Supervisor of Utilities Vickery has approved the suggestion that the city accept one of several offers to utilize gas generated by the city sewage disposal plant in operating an electric light and power plant. "Several concerns have offered to build the plant without any cost to the city other than the amount paid at present to the Texas Electric Service Company for power service," Vickery said. "The plant would save the city at least $17,000 a year on power bills for operation of the disposal plant alone. It would cost about $40,000 to build the plant and it would pay for itself in three years." It also was pointed out that such a plan might serve as a nucleus for a municipally owned light and power plant should the city charter be amended to provide for the establishment of it.

EDITORIALS

L. W. W. MORROW
Editor

Death calls Frank W. Peek, Jr.

A SURPRISED and shocked industry learned the accidental death of Frank W. Peek, Jr., with great sorrow and regret. For he stood in the front ranks and yet had reached only the noon of life. He was at the rounded period of maturity and experience to contribute even more to the industry in the future than he had done in the past. The loss of this master engineer is beyond measurement or replacement both to his company and the industry.

As a specialist on lightning F. W. Peek stood alone and in the realm of transmission, transformation, insulation and protection his work was outstanding. His brilliant mind established his reputation as a pioneer research worker and in addition as an executive engineer. His technical publications gained him worldwide renown and advanced the art he served. He was a master engineer and scientist.

But a host of friends and associates mourn the loss of a friend even more than they regret the loss of the technical talents of Mr. Peek. To know him was to admire and love him. For he was a gentleman in the best sense of the word. He was modest and unassuming. He was interested in other people and was never too busy to give an encouraging word and smile to young engineers who brought him their problems. He was considerate and never forced his opinions upon others, yet, when solicited, would state them clearly and logically. His reactions to associates were always sincere and spontaneous and his loyalty and integrity of the highest. As a friend, as an engineer, as a teacher F. W. Peek, Jr., possessed the talents and the personal characteristics that stand for leadership of the highest type.

Can power sales efforts be measured?

INDUSTRY has shown a decided upturn of late and power sales departments are most conscious of this change. Many power sales managers believe this upturn forebodes both good and evil. Opportunities to increase loads and to add new customers will increase, they say, but so will threats to existing business.

Forward-looking power sales executives are now laying plans to meet these new conditions by making certain that the department itself is organized for the most effective attack. More men are making certain that their own organization is well in hand, that its efforts are being directed in those areas in which they will be most effective. They are finding it increasingly important to be able to determine the direction of the efforts of the personnel and to measure accurately the results of these efforts. It will become increasingly necessary for the power sales department to establish standards by which its performance may be judged. For, rest assured, it will be judged by the company executives. One responsibility of the power sales manager is to provide the management with reliable standards of measurement if the department is to be fairly judged.

Measurement is largely a matter of intelligent application of commonly accepted standards. Yardsticks for power sales are quite as necessary as for engineering performance, but somewhat less subject to exacting and absolute determination. This condition exists because of the necessity of applying the yardstick to men instead of machines. There is also some lack of agreement among power sales executives as to what standards of performance are of first importance. In this issue of ELECTRICAL WORLD an experienced power sales

executive puts forward and discusses several yardsticks for power sales. All utility commercial executives will be interested in the presentation of a problem that will receive increasingly critical attention by their company managements, as business continues on around the corner.

Standardization is bequeathed by bureau to industry

ANNOUNCEMENT of the transfer to the American Standards Association of some, if not all, of the standardization activities of the Bureau of Standards stirs mingled emotions of relief, alleluias and regret. Those who were irked by the burden of continuous participation in trade conference on codes and simplified practice will heave a sigh that this Hooverism has been discarded, but later they may ponder what they will have drawn in its place from the new deal. Those who profited by simplification and standardization will rejoice that this function now reposes in industry itself even if it has to be supported directly by assessment instead of indirectly by taxation. Trade standards, specification, simplified practice and safety codes will hereafter be drafted by sectional committees of the A.S.A. with undivided authority and direction.

There is no denying the fact that immense benefit has accrued to industry, to its conflicting and complex groups, to producers and consumers alike from what has already been done by way of standardization. There will be a continuing need for new standards and for revision of existing ones. In many respects the general program had arrived at the point where the educational phase had been passed and that government thus could safely withdraw before bureaucracy crept in with its dictatorial perversions. Governmental economy has precipitated what might well have come in due course as business opinion asserted itself. The bureau will undoubtedly continue a portion of the laboratory research that underlies codes and specifications and the problem for industry to face is that much simpler. But government research at the bureau should continue unabated to define fundamental standards, to make refined measurements and to perfect government purchase specifications.

Meet the lady's dream of mastered lighting

"YES, but why must there be so many places to go to turn the switches? Why can I not have three levels and tones of general illumination? Why can I not get added esthetic effect from light as light? Why must I always face committing myself to some transient style of ornamentation because light sources rule over light itself? Why must I compromise all my love for drapes, pictures and pleasing arrangement of the furnishings in order to have panel or modernized lighting, as you call it? And why must my architect feel impelled to caution me about the expense for wiring?"

Now that may be exaggeration and it may be more vocal than most housewives are on the subject of home lighting. But it does express some of the inarticulate hesitancy that lies back of the retarded program. One time panel lighting is emphasized. Another time it is wall brackets. Again it is the floor and table lamp and the outlets for them. On other occasions it is indirect and pillar lighting. But seldom is the assembly displayed in such a way as to answer the conflicts that come from staggered emphasis.

When ambition revives it will be well to plan home-lighting demonstrations that put prime stress on the light for its own sake and secondary emphasis on the artistry of the orifices from which it radiates its blessings. Woman today still has all her innate love for the beautiful. But she has acquired the sense of management and mastery over her environment that must be titillated before she falls for selling lures. Perhaps some one will sense this enough to set up a model home in which the living room will have the inescapable appeal. When the mistress enters it in the grand manner she will find one unobtrusive switch location from which she can flood the room, bathe the room or subdue the room with light as befits her caprices. She can switch ornamental lights on or off to match the mood of the occasion. From the same location she can command the portables with equal insouciance. Then, perhaps, she will see the virtues of the new deal in lighting a home to make it temperamentally homey, without gaudiness, without cluttering and without intricacy.

Modernizing Pioneer Waterwheels

By T. C. STABLEY

Chief Operator Holtwood Hydro Station, Pennsylvania Water & Power Company

ALTHOUGH the Holtwood development on the Susquehanna River marked an important advance in hydro-electric design at the time of its installation, in 1910, the vertical double-runner waterwheels in it would have been superannuated a decade or more ago because of wear and deterioration had it not been for progressive modernization. However, after 23 years of severe service, the seven units of this type, totaling 101,500 hp., are now in condition superior to what they were when installed, although they have generated more than 7,333,000,000 kw.-hr.

The improvements have not only reduced maintenance expense but also outage time for repairs and scheduled upkeep—a very important factor in hydro-electric plants. Whereas general overhauling of each turbine had to be done every two years, it is now expected that once every twelve years will be sufficient.

Several conditions contributed to the necessity for making changes: The vertical double-runner wheels have a large number of parts which must operate submerged. No provision was made for lubrication of these parts. Ferrous metals had been used exclusively for the submerged pins, links and bearings, with the exception of the brass sleeves on the main shaft inside the lignum-vitæ bearings. The Susquehanna is highly corrosive because of its sulphuric acid content from coal washeries above the plant. Considerable quantities of sand, silt, etc., are carried in the water during spring freshets and other flood periods. As a result unprotected steel and iron parts were quickly attacked to such an extent that their cross-section was reduced and lost motion occurred at various pins and bearings, seriously interfering with operation and output. The presence of abrasives over long periods was responsible for rapid wear of the vane-operating mechanism and also in the submerged main-shaft lignum-vitæ guide bearings and sleeves that were lubricated by water supplied directly from the wheel pit.

Fortunately the liberal dimensions of the working parts made it possible in the modernization program to provide space for bushings and replace the original wearing surfaces with more suitable materials. Use of alloys played a very important part in the modernization. Where there had been no provision originally for lubrication, alterations have been made to permit sufficient grease capacity to maintain lubrication between periods of regular inspection. Rubber bearings have been substituted for the lignum-vitæ, which was found unsuitable due to abrasives in the river water.

Before considering the detail changes which were made to prevent the troubles experienced from corrosion and lack of lubrication, attention should be called to some conditions that existed in the original wheels.

The cast-steel operating rings actuating the guide vanes through forged steel links had not been provided with brass liners on the bearing surfaces which were supported by the cast-steel guide rings, made of five segments. Furthermore, the latter had no brass liners on the horizontal and vertical facings to ease the turning movement of the operating rings. The steel links connecting the operating rings with the guide vanes had no brass bushings in their pin connections, yet there were two of these links per vane, with a total of 80 unbushed pin connections or 160 moving contacts for these 20-vane wheels.

The steel guide vanes, which are 3 ft. 4 in. long, pivoted on 4-in. steel fulcrum pins without any provision for lubrication. Due to the slight clearance between the vanes and the pins corrosion rapidly "froze" the two together, so that in one case it took a 25-ton jack to force the pin from the vane.

Corrosion of these parts and similar conditions in the

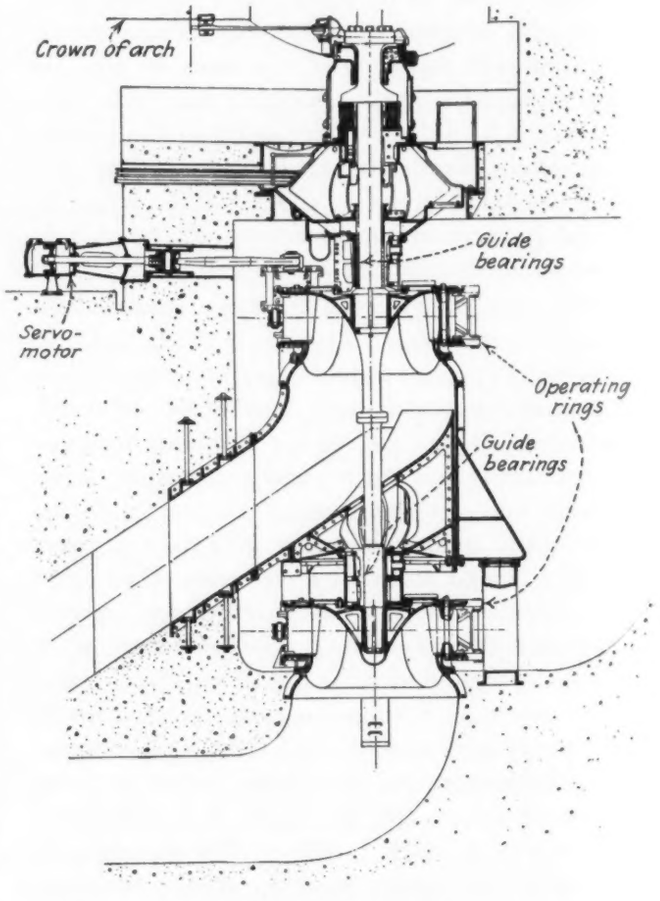


Fig. 1—One of the seven double-runner turbines which were modernized

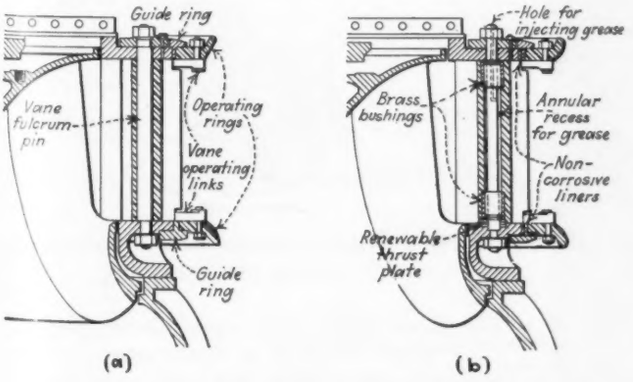
Observe all submerged operating parts were exposed to corrosion or abrasion by the river water and were not originally lubricated.

Much equipment which was installed years ago, even if it has been maintained in good physical condition, has become obsolete due to developments in design and materials. To continue its operation under such conditions results in a yearly loss which justifies modernization or replacement by modern equipment. Balancing of the fixed charges on cost of changeover against possible savings, the amount of unretired investment scrapped, economic conditions affecting the securing of new capital, and urgency of planning for the future—all have their influence on which course should be followed.

In the case related by T. C. Stabley progressive modernization rather than replacement was chosen. The methods used may be of value to other users of old waterwheels if conditions do not permit of replacing the units with new types.

two bearings of the large operating shaft and the four operating rod connections increased the friction to such an extent that in time the gates would have been inoperative. In fact, the movement of the operating mechanism became so sluggish that the governor-fluid pressure had to be increased from 125 to 250 lb. to obtain adequate control.

Operating and Guide Rings—The first step to eliminate friction was to attach ¼-in. thick brass faces to the bearing surfaces of both the operating and guide rings (Fig. 2b). This modification produces marked improvement by reducing friction and served fairly well for about two years, but the brass was too soft to withstand both weight and torsional stresses imposed by the motion of the guide vanes. The brass-to-brass contact developed deeply grooved surfaces, hastened by the abrasive action of sand and silt. The wear was so rapid that after several years the operating rings dropped sufficiently to come into contact with the link pins on top of the vanes and so restricted the movement of the mechanism.



Figs. 2a and b—Guide vane assembly before and after modernization

Note non-corrosive liners between operating, distributing and guide rings, annular space for grease and means of filling, renewable thrust plate (shown in detail in Fig. 5) and brass bushings at top and bottom of fulcrum pin.

The second and final step was to remove entirely the tongue on the guide rings (Fig. 3) and attach ½-in. thick brass (88 per cent copper, 10 per cent tin, 2 per cent zinc) liners on the outside circle of the distributor plates and on the inside of the operating rings. The ¼-in. brass liners on the bearing surface of the guide rings were removed and ½-in. thick "Damaxine" metal liners attached to the bearing surface of the operating rings. The latter alteration required that the guide rings be lowered ¼ in., which was accomplished by shims placed between the guide rings and distributor to which they are bolted. This combination of "Damaxine" in contact with cast-iron worked admirably, with practically no wear on either metal, because of the low coefficient of friction of the former, which is a composition of copper, tin and lead.

Another suggested improvement to reduce the metal-to-metal friction between the operating and guide rings is to replace the existing cast-iron guide rings with similar rings faced with lignum-vitæ. A considerable reduction in friction should result because the surrounding water is sufficient to lubricate lignum-vitæ. The wear, if any, should be taken up by set screws in the guide rings to keep the operating ring level with the distributor.

Connecting Links—The pinholes in the forged steel links were bored out and fitted with ¼-in. wall, cast-brass bushings. This treatment stopped corrosion at these points.

The design of the connecting link and pin assembly is such that effective lubrication cannot be readily applied, and this remains a vulnerable point of attack from sand and silt. A solution of this problem would defer renewal of the brass bushings and improve regulation of the unit by the elimination of lost motion occasioned by the wear of link bushings.

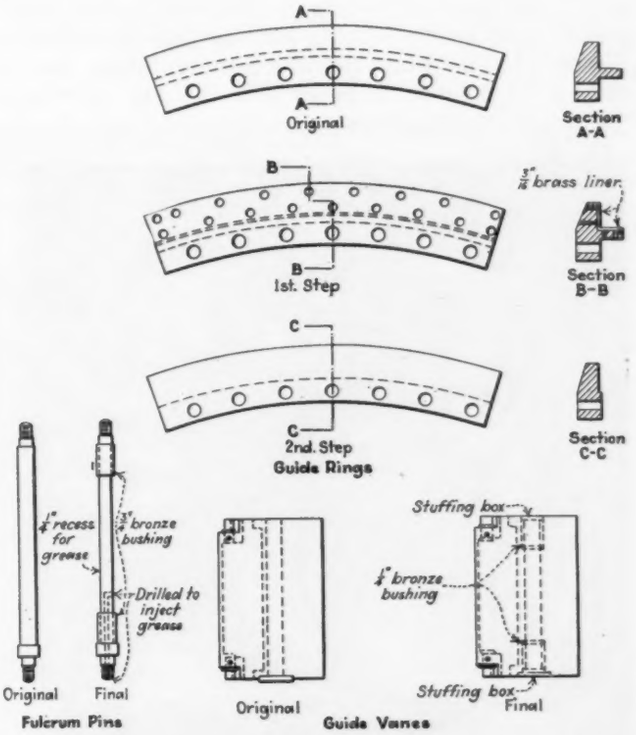


Fig. 3—Modifications made in guide rings, guide vanes and fulcrum pins

Consideration is now being given to revamping the links by reducing the thinness at eyes, employing lead gaskets on vane and operating-ring end of pins and covering the exposed hole in link with a brass plate. Lubrication is planned to be provided by drilling the side of the link eye and attaching a mogul Dot or Alemite grease fitting. Packing these parts with grease should give sufficient lubrication for six months and definitely prevent the entrance of water or sand.

Fulcrum Pins and Vanes—A decided improvement of these parts was made by reducing the bearing surface of the fulcrum pins and attaching ¼-in. brass bushings at top and bottom. In addition the vanes were bored out and fitted with bushings top and bottom (Fig. 3). The fulcrum pin diameter was reduced between the bushings to serve as a grease reservoir for the bushings. The annular space produced between the pin and vane is 24 in. long and ¼ in. deep and holds 4 lb. of lubricant. By drilling a ½-in. hole 10 in. deep from the top of the fulcrum pin grease is admitted to this annular space. Another important feature of the lubricating plan was to provide a stuffing box at top and bottom of each bushing to retain grease and prevent entrance of sand and silt. This was accomplished by reducing the length of the bushings sufficiently to insert two rings of oil-proof packing. The packing is retained by attaching a ¼-in. thick brass plate on top of the vane and a similar one of stainless steel on the bottom, which also serves as a renewable wearing plate for the vane.

Renewable Wearing Plates—The original vane thrust washers consisted of a loose ¼-in. thick brass plate 8 in. in diameter. However, the movement of the 800-lb. steel vane and the presence of sand rapidly wore the brass plate, and the latter cut into the distributor plate below each vane causing a $\frac{1}{16}$ in. deep counter-bore.

This undesirable defect was effectively overcome by three changes: (1) Counterboring the lower or thrust end of the vane and attaching a ¼-in. thick by 8-in. diameter stainless steel renewable wearing plate as previously mentioned; (2) counterboring the distributors and attaching similar wearing plates (Fig. 4), and (3) placing a ¼-in. thick floating monel metal disk between the vane and distributor wearing plates (Fig. 5). The stainless steel plates are made of a machinable grade of 18 per cent chromium and 8 per cent nickel alloy. This arrangement has proved highly satisfactory and after six years service the plates have had no appreciable wear.

Main Pins—There are a total of ten large pins between the servo-motor cylinder and operating rings, i.e., one cross-head pin, one connecting rod pin and eight operating rod pins, each 4 in. in diameter and 18 in. long. The original pins were made of machine steel and cor-

Submerged Service in Which Alloys Proved Effective

	Composition, per Cent
Vane and fulcrum pin bushings	88 copper, 10 tin, 2 zinc
Radial liners on operating rings and distributors	88 copper, 10 tin, 2 zinc
Connecting and operating rods and vane link bushings	88 copper, 10 tin, 2 zinc
Bearing liners on operating rings	75 copper, 10½ tin, 14 lead
Vane thrust washers	Monel metal
Link pins	Monel metal
Vane and distributor renewable wearing plates	18 chromium, 8 nickel
Main shaft bearing sleeves	25 chromium, 15 nickel

Experience indicates that in new installations stainless steel bushings be shrunk on the steel vane shafts at top and bottom guide bearings to prevent water from corroding and reducing size of shafts.

A new and promising alloyed bushing metal consisting of 80 per cent copper and 20 per cent of a patented hardener has recently become available; its physical characteristics appear as though it will be very resistant to abrasion for under-water service. Castings of this composition when tooled have long and tough turnings, similar to a good grade of steel. Trials are under way here to determine the value of the material for turbine use. The new alloy is a European development and said to be unusually durable and used extensively in submerged working and bearing parts of canal lock gates which are exposed to water charged with silt.

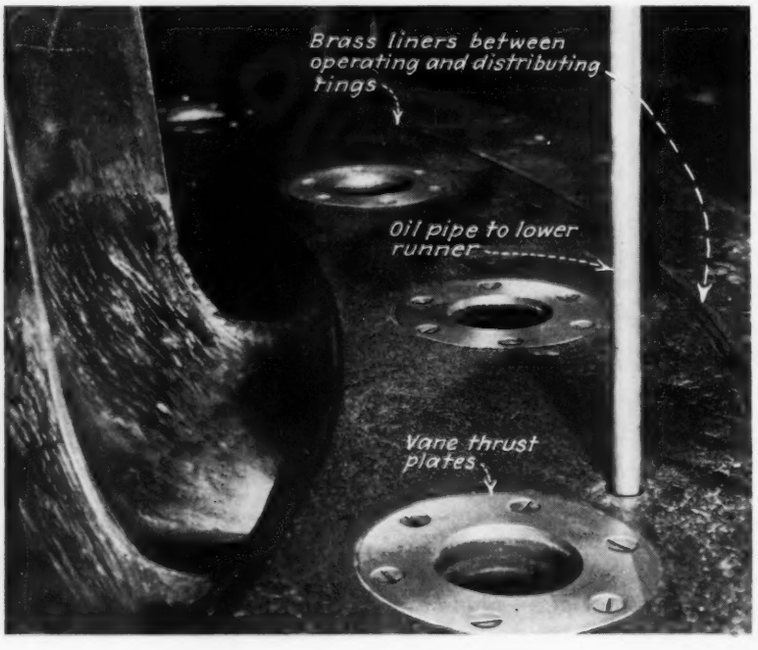


Fig. 4—Stainless steel renewable wearing plates attached to distributor

These plates support the thrust of the guide vanes (see Fig. 5). The pipe at the right is one of five conveying grease to the vane bearings on the lower runner. Each passes through the large core hole in a guide vane and hence does not restrict action. The brass liners on the periphery of the distributing rings and the inner circumference of the operating ring may be faintly seen.

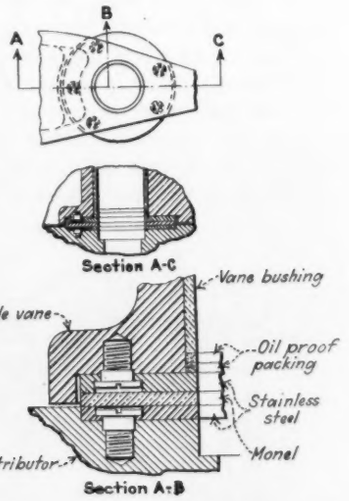


Fig. 5—Improvements made in vane-thrust wearing plate assembly

roded rapidly, causing considerable lost motion. About eight years ago a set of pins was replaced by others made of stainless steel, which did not corrode. Such a marked improvement resulted from the use of this superior non-corroding metal that all heavy pins are now replaced either by solid stainless steel or else old pins turned down and built up with stainless steel surface, arc welded and machined.

Link Pins—In each vane there are two link pins 2½-in. in diameter, one on the upper side and the other on the lower. Corresponding pins are in the operating rings. Originally these were made of machine steel, but corrosion was so rapid that after two years they were sufficiently reduced in size to cause so much lost motion that the vanes could neither be closed tight nor opened wide, so that the capacity of the unit was reduced 300 to 400 kw. This condition was corrected by substituting pins made of monel metal. The first experimental pins are still in excellent condition without showing appreciable wear. All units are now equipped with similar monel metal link pins.

Lubrication of operating mechanism

Main Pins—As previously stated, no provisions were made originally for lubrication of the submerged moving parts, a fact which was largely responsible for the rapid corrosion of the ten main pins. To remedy this situation each unit was provided with a 25-lb. hand-operated grease gun installed on the generator floor with ten ½-in. pipe extensions to the various pins, the lowest being 50 ft. from the gun. Inside the wheel pit the piping was protected by placing it within the tubular operating shaft, with movable connections afforded by flexible right-angle pipe fittings (Fig. 6). Provision of these lubricating facilities has greatly improved the operation of the mechanism and has increased the life of the pins. When the first installations were made both galvanized wrought pipe and steel pipe were used, but these were attacked quickly by corrosion and so had a life of only about five years. Replacements were made with extra heavy copper pipe which will give many years of service. So that the lubricant would flow to the lowest pins with low water temperatures an "absorbed" oil was selected which is not soluble in water.

Vanes—Greasing of the upper runner vanes (Fig. 1) can be done at any time with the headgates lowered by removing a brass plug in the upper end of each fulcrum pin and filling with a portable grease gun. However, since the lower runner is always submerged, it was necessary to extend five ¾-in. extra-heavy copper grease pipes from the lower turbine to the top of the upper unit. These were accommodated by drilling the two distributor plates of the upper unit at five equally spaced points where each pipe could be run through the large core hole in the blunt end of a vane without hindering the movement of the latter (Fig. 5). Each pipe was connected to a manifold which serves four vanes. The grease inlet for each pipe is fitted with a ¾-in. heavy-duty cock. A grease, sufficiently fluid during freezing water temperatures, is forced into vanes semi-annually, a unit requiring approximately 50 lb. yearly.

Provision of vane and fulcrum-pin lubrication defers the replacement of these vanes from five years, originally, to as much as twenty years.

Guide Bearing Linings—Seven years ago the author reported the satisfactory operation of an experimental rubber guide bearing installed on a vertical 1,000-hp. exciter turbine in November, 1924. It has been in continuous service since that date. The superiority of this type of bearing over the conventional lignum-vitæ bearing was so pronounced that numerous installations have been made throughout the continent. Rubber has also been used successfully in submerged and ship propeller bearings. Its reliability has been attested to by its gradual adoption in hydro stations during the past few years for shafts varying in size from 9 to 30 in. and unit capacities from 300 to 45,000 hp.

Because of the demonstrated superiority of rubber over lignum-vitæ for such applications the submerged lower guide bearings of the double runner units at Holtwood are now being replaced with rubber at the rate of one each year. The first installation was made in 1929 and after four years service is in excellent condition (Fig. 7).

The original lignum-vitæ bearings required reblock-

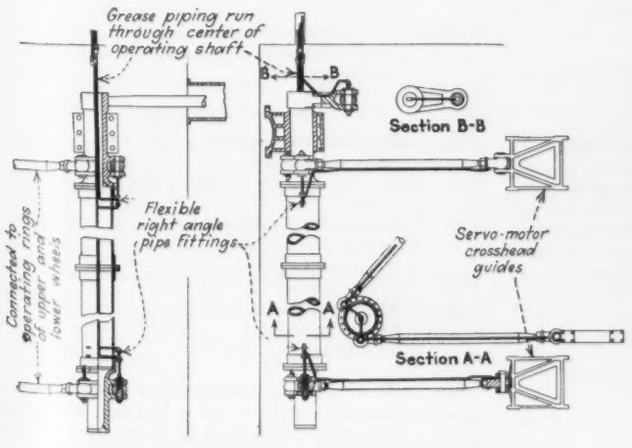


Fig. 6—How grease was conveyed to bearings on servo-motor operating shaft

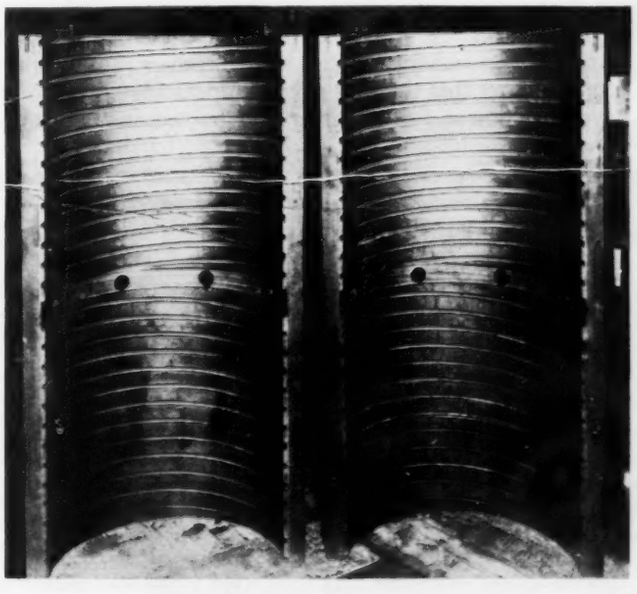


Fig. 7—Rubber lining which replaced lignum-vitæ on 17,000-hp. turbine guide bearing
It is 4 ft. 2 in. long and had a bore of 21 in.

ing every two years because of wear. Besides, the brass sleeve on the shaft wore thin and eccentric. On the exciter installation, previously mentioned, the brass sleeve also wore rapidly because this metal is too soft and because the rubber surface, combined with silt and sand, acts as a lapping head that grinds off the metal. This condition was corrected in the main units by replacing the worn brass sleeves with similar parts of stainless steel (25% chromium and 15% nickel). It necessitates annealing after casting and internal and external finished dimensions are only obtained by use of grinding tools. Because of its hardness the metal is extremely resistant to abrasion. The first sleeve of this type to be installed indicated a wear of 0.0005 in. after two years of service. So far with four years service, using for lubrication river water charged with sand and silt, both sleeve and bearing show no perceptible wear and have still the original new appearance. Six rubber bearing installations have been made in this station for units ranging from 1,000 to 17,000 hp.

Operating Shaft and Bearings—The hollow steel operating shaft, which is turned by a connecting rod from the servo-motor and moves the operating rings of both upper and lower turbine by reach rods, is 30 ft. in length and has journals at both ends, 16 in. diameter by 3 ft. long. The original upper and lower pedestal bearings were fitted with three segmental lignum-vitæ adjustable shoes without lubrication other than the wheel pit water. Corrosion of the steel journals was rapid and the reduction in diameter, plus the wear of the lignum-vitæ, caused as much as $\frac{1}{4}$ to $\frac{3}{8}$ in. lost motion.

This condition was corrected by replacing entirely all of the original bearings with others having brass bushings and providing lubrication. The shaft journals were turned down and built up with stainless steel (18 per cent chromium, 8 per cent nickel) and machined to the proper diameter. Entrance of water into the bearings is prevented by stuffing boxes which hold two rings of $\frac{3}{8}$-in. thick felt.

Servo-motor Pistons—The servo-motor pistons were originally designed to use textile packing. As the governor fluid has to be specially treated water to reduce corrosion it had a tendency to soften and deteriorate the packing, which consequently required replacement every two years. Modifications were made in the piston heads to permit using two metallic rings, which proved effective and durable and should give many more years of service.

Conclusion—The research experience gained with the various metal alloys used has in a large measure determined the selection of similar metals for the parts likely to be similarly affected in the modern large Kaplan turbines installed in the Safe Harbor plant, placed in operation in the latter part of 1931, and is freely available to those who are encountering troubles arising from problems such as have been solved at Holtwood.

▼ ▼ ▼

Coal-Handling Costs for Powdered-Fuel Plant

An Eastern central station of 80,000 kva. rating recently filed with one of the state commissions data bearing on the unit operating and maintenance expenses of unloading, storing and reclaiming, preparing and transporting coal for pulverized fuel operation. The data covered a period of one year. During the latter part of the fuel year oil was burned in increasing quantities as well as pulverized coal, but the tabulation is of interest in relation to various per-ton power consumptions, apart from the fact that the unit over-all operating costs would have been lower for handling and pulverizing had only coal been used during the year. The labor requirements of the handling plants per ton would also have been somewhat lower with coal alone and if figured at current rates. As a yardstick for operating comparisons, however, the data possess some significance.

The main coal-handling system was designed to care for a maximum of 400 tons per hour. Coal was unloaded at the wharf by a single-boom, electrically-operated tower feeding a shuttle conveyor discharging either to a conveyor or to ground storage. There were six raw coal conveyors (400 tons per hour), a drag scraper at the storage pile, coal breaker and preparation plant. This last has three mills (each 15 tons per hour), hot-air drying system, air compressor for the pulverizing plant and screw conveyor coal transport (100 tons per nour). Tabulated power requirements follow:

Unloading

Coal per hour, tons (short)	200
Power used, kw.-hr. per ton	0.724
Operating labor, man-hr. per ton	0.085
Maintenance labor, man-hr. per ton	0.021
All labor, man-hr. per ton	0.106
Operating costs, cents per ton	4.320
Maintenance costs, cents per ton	2.363
Total unloading cost, cents per ton	**6.683**

Storing and Reclaiming

Average coal per hour, tons	128
Power used, kw.-hr. per ton	0.707
Operating labor, man-hr. per ton	0.039
Maintenance labor, man-hr. per ton	0.014
Total labor, man-hr. per ton	0.053
Operating labor cost, cents per ton	2.310
Power costs, cents per ton	0.162
Lubrication cost, cents per ton	0.144
Miscellaneous cost, cents per ton	0.003
Total operating cost, cents per ton	2.562
Maintenance labor cost, cents per ton	1.076
Maintenance cost (material), cents per ton	0.474
Total maintenance cost, cents per ton	1.558
Total storing and reclaiming cost, cents per ton	**4.120**

Preparation and Transport

Power used, kw.-hr. per ton	15.521
Coal prepared, tons per mill-hr.	19.227
Coal transported, tons per pump-hr.	39.601
Moisture entering mills, per cent	5.6
Moisture in and leaving mills, per cent	2.2
Fineness through 200-mesh screen, per cent	73
Fineness through 100-mesh screen, per cent	93.2
Fineness through 60-mesh screen, per cent	96.8
Operating labor, man-hr. per ton	0.144
Maintenance labor, man-hr. per ton	0.05
Total labor, man-hr. per ton	0.194
Steam for drying, lb. per ton	86.6
Journal oil, pints per ton	0.11
Operating labor costs, cents per ton	8.975
Lubrication costs, cents per ton	1.423
Power costs, cents per ton	4.68
Steam for drying, cents per ton	2.17
Miscellaneous costs, cents per ton	0.242
Total operating costs, cents per ton	17.59
Maintenance labor costs, cents per ton	3.671
Maintenance material cost, cents per ton	1.172
Total maintenance cost, cents per ton	4.843
Total preparation and transport cost, cents per ton	22.433

Coal Analysis

Coal used, Sewell seam, New River	
Grade, nut and slack	
Moisture (coal wet to prevent dust), per cent	5.115
Volatile matter, per cent	20.97
Fixed carbon, per cent	68.93
Ash, per cent	4.41
Sulphur, per cent	0.58
B.t.u. as received	13,960
B.t.u. as burned	14,380
B.t.u dry basis	14,720

(Power generated by fuel oil increased from zero in January to 83.8 per cent in August), The average load factor of the station for the year was 55.97 per cent and the capacity factor was 52.03 per cent.

The total generated output of the plant in the year was 319,226,160 kw.-hr.

The Capital Crime

By R. J. GAUDY
Consulting Engineer, Chicago, Ill.

OTHER men may plead in excuse for their shortcomings that "it was being done" or "it was requested." But the engineer is denied this privilege when he renders an account of how he spent other people's money. Looking back over much industrial and utility construction of the past few years too often are there clearly apparent evidences to support the charge that the engineer is frequently guilty of the "capital crime" of unwarranted use of invested funds to attain an ideal of pluperfect performance. The ideal of perfectly adequate industrial or utility service rendered with absolute reliability has too often been achieved at an expenditure of capital cost which the achievement could never hope to repay.

The managers of utility, transportation and industrial undertaking asked their engineers, "Cannot a service be so provided as never to suffer interruption, never to be short in capacity and never to require apology?" The engineers, with pride in their wares of brain and material, lustily shouted "Yes." The capital crime occurred right then if the engineer lowered his voice to add, "If you will arrange to pay the cost," or neglected to utter that saving remark at all.

The capital crime consists of a determined effort to provide service of 100 per cent capability and reliability regardless of cost. The engineer avoids criticism of his work by such effort to supply such service. But for the engineer to attempt to avoid criticism by unwarranted use of capital funds is for him to commit an economic crime in his desire to save his personal feelings. The perfection of service assumed by the engineer to be required is not often really desired by the users of that service if they have any understanding of its excessive cost.

Pluperfect service or sensible investment?

Thrifty Mr. Citizen saved his money and bought three bonds. One is on the plant where he is employed, one on the transportation system that carries him to and from his work and one on the water system serving his home. He is worker, customer and owner of these three undertakings. His own money was spent to provide him employment and to supply his needs. Suppose that it is put up to him to make a choice in each of the following alternatives:

(a) Would you prefer to be a little chilly at work while the temperature crawls up from 65 to 72 deg. F. on four mornings during the winter rather than to tear up your bond on the plant?

(b) Would you prefer to wait five minutes for a street car on a few nights per year rather than to insist on instant service and, for the privilege of stepping aboard exactly when you are ready, burn up your transportation bond?

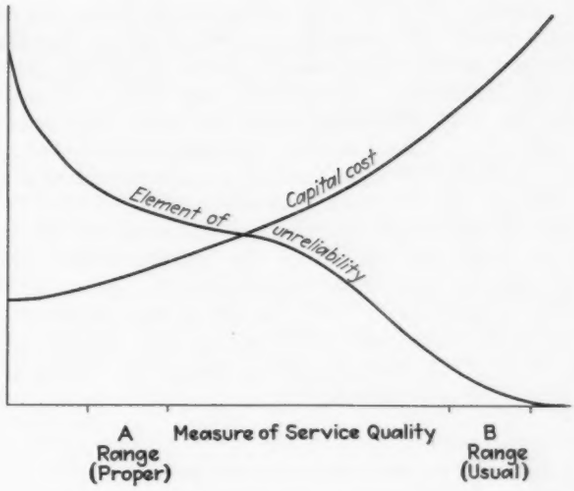


Fig. 1—High cost for high service quality
The service quality range of "B" is usual, but quite often unnecessary and much capital investment could be saved by the acceptance of service quality in range A.

(c) Would you insist on water service of maximum capability on some random nights during the summer so that you might water the lawn just when the idea struck you and, to enjoy such service, sacrifice the water bond?

It is not at all necessary to ask Mr. Citizen if he would demand these super services if he thoroughly understood that by so doing the effect might be to require a century to amortize his investment. His choice would inevitably be to curtail the services under extraordinary demand and thus keep his hard-earned capital investment protected.

A million to assure five days of comfort

Here are a couple of examples of the "capital crime"—one a case of "might have been" and the other actually committed:

A large industry adding factory space faced the presumed need of a million-dollar addition to the heating plant. The existing plant included the usual spare capacity in reserve. The management was ready to proceed with the proposed extension. The situation was set forth:

1. The present plant can serve the entire load, old and new, with limitations.

2. On five mornings during each winter the present plant on full duty will delay bringing the new space up to full temperature until noon. On all other days the temperature will be normal at all times.

3. If the present plant had the worst breakdown that previous experience says may occur, then the workers might have to be sent home for some part of the week. The probability that such breakdown would occur on the particular days when load is greatest is very remote.

Under other than these extreme conditions the present plant will render full service at all times with no additions. If the million-dollar addition were made the annual expense for this assurance of perfect adequacy would be $135,000 plus some added payroll. The response in this case to the question "Is it worth it?" was "No," positively and with profane embellishments to add emphasis.

In another case of the actual commitment of the "capital crime" the peak load was 45,000 kw. Curtailed production could be endured without great loss on an available 25,000 kw. The possible curtailment of load of 20,000 kw. for 1,200 clock-hours during the year was an acceptable risk. Many of these possible capacity shortage hours would fall in night and other non-productive times so that the loss in annual factory output would be no more than that from several other uncontrolled hazards. But the engineers on whom the service responsibility rested insisted that future growth justified units of 35,000 kw. capacity each and that three units must go in to avoid the stigma of restricted service. The capital component of the energy cost was thus made 210 per cent of what it should have been.

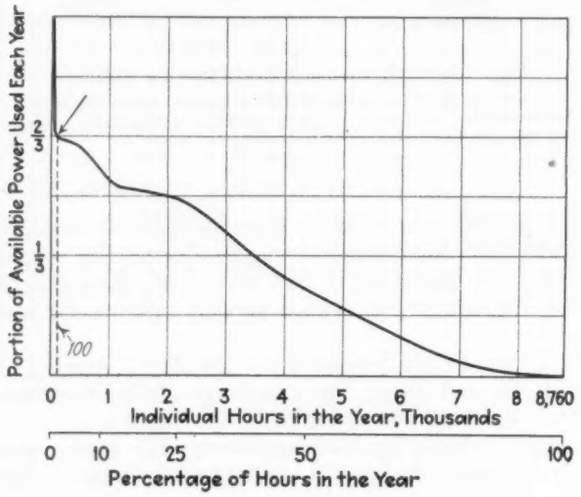

Portion of Available Power Used Each Year
2/3
1/3
100
0 1 2 3 4 5 6 7 8 8,760
Individual Hours in the Year, Thousands
0 10 25 50 100
Percentage of Hours in the Year

Fig. 2—Peak capacity needed less than 10 per cent of time

Investigation of factory operations disclosed that one-third of plant capacity was used only when raw material piled up. Payment of small demurrage charges on freight cars saved a third of proposed power plant investment.

The plant concerned has suffered greatly from this unwarranted burden during the period of reduced output of the past three years. The sources from which the excess capital was drawn have also suffered. The financing underwriter earned his commission on the sale of the securities for this plant extension, but at this date he would be happier to have sold his customers half as many bonds, all of which could have paid their interest and could have been amortized.

In every assembly of materials for the performance of a given service the conditions shown in the accompanying graph apply. As steps toward perfection are added to eliminate possibly shutdowns or shortages of capacity the capital outlay mounts rapidly. Most projects have been assumed to require the small element of unreliability included in range B. But many projects if intelligently analyzed would fall in range A for reasons of capital economy. No engineer should proceed with a development without establishing an analysis like the graph illustrated in Fig. 1 so that the authority for capitalization may know the cost burden of each increment of increased reliability.

There are conditions wherein the outage expense or peak responsibility will demand maximum attainable performance. In such cases the manager and the engineer are justified in the expenditure of capital for the attainment of such result. The "capital crime" is committed in those cases in which a possible insufficiency of service is avoided by a largely disproportionate capital outlay.

"Maxima chasing" a costly pastime

Large numbers of "capital crimes" are inspired by what might be termed "maxima chasing." The engineer is glad to accept orders for a plant that must handle any stated maximum duty in kilowatt-hours per hour, thousands of gallons per minute or whatever measure of capacity applies. As he sees it, his duty is not to reason why the maximum exists, rather it is to do or die in the attempt to build a plant to encompass it. A case in the recent experience of the writer dramatically demonstrates the danger of "maxima chasing."

The management knew that the business had on occasion used 30,000 kw. A new power plant to handle this demand was ordered designed. A general study of the plant's production indicated that 20,000 kw. should have been an adequate maximum. The engineer began to look for the extraordinary condition which created the high demand, and which raised the required capital outlay by 50 per cent, requiring that one-third of the capital should be set aside solely to serve this abnormal condition.

The record of energy consumption was taken for each clock-hour of the previous year. These records were plotted, not in the order of their occurrence, but in the order of their magnitude from the lowest to the highest as shown in Fig. 2. When the hourly loads were set up in this way the following significant facts were immediately apparent:

1. A load of 30,000 kw. was served for one hour.
2. Loads exceeding 20,000 kw. occurred during only 100 individual hours.
3. At no time were loads exceeding 20,000 kw. sustained through more than three consecutive hours.
4. The peaks were not seasonal.
5. The peaks had no fixed relation to the working week.
6. Peak occurrence had no regularity of interval.

On investigation it was discovered that the peaks were created by the concentration of arrival of raw material. When the management saw this analysis it immediately saw also the advisability of paying the small demurrage charges necessary to spread the period of introduction of raw material into the process. This controlled unloading not only saved one-third of the capital outlay to power but had a favorable effect on plant labor costs and upon the tonnage cost of product.

It is obviously the duty of the engineer to extend his economic analysis to a point where the budgeting management may have opportunity to act toward the control of conditions creating peaks; to allocate intelligently load usages in relation to each other; to avoid duplication of capital outlay where capital already invested by others may be used; to accept a bearable risk of unreliability in order to avoid unwarranted capital expense, and to intensify the use of capital facilities. Foremen are trained to prevent loitering on the part of the payroll dollar. The engineer is supposed to be trained to the same police duty on the invested dollar, but he has failed very considerably in that duty and has thus become a principal actor in the "capital crime."

Yardsticks for Power Sales

By DEAN W. TAYLOR*
Utility Management Corporation

THE success of a power sales department is quite often judged by the annual growth in total revenue from energy sold to all industrial customers, both new and old. At other times the total connected load of added power business that has been obtained from all sources is used as a measure. A safer and fairer basis of measurement than these must be established if the power sales department is to get proper credit for what it does accomplish and is not to be credited with additions to the company's revenue with which it had nothing to do and toward which if put forth no specific effort. In the absence of a definite standard of performance a weak power sales department working in a growing territory may claim credit for more accomplishment than it has been responsible for and, on the other hand, a strong department, working against the severest kind of competition, may not receive the credit that is due.

Four principal duties of the power salesman are:

1. Holding business with existing customers.
2. Adding load to existing customers—
(a) Through new applications of electricity within a given plant.
(b) Through factory additions.
3. Shutting down private plants.
(a) Taking over the entire power load.
(b) Taking over only part which leaves the customer with a perfect heat balance.
4. Securing new customers in new locations.

A standard of performance to be fair to all salesmen should take into account all of these factors and give the proper weight to each.

Holding Business—This may mean simply satisfying minor complaints, or it may require a thorough study and report on the possibilities of competitive power. In the latter case, the power salesman should be given some specific credit, measured by the volume of business that would have been lost to competitive power, provided the customer had a good case and provided there was every reason to believe that he would have installed his own plant but for the efforts of the salesman. In the early days of power sales work very little credit was given for this kind of work and in recent years the tendency has been to give perhaps an undue amount of credit and to allow an unnecessary amount of time to be devoted to this activity. There is hardly a territory in which a power salesman could not spend all of his time in calling on existing customers and anticipating possible private plant installations, but if his time is spent entirely on complaints, and not at all on active development of the customer's existing load, the power sales department will not have a very satisfactory showing to make at the end of the year. Holding business is a worthy accomplishment, but should not be used as a cloak for failure to sow the seeds and cultivate the soil from which new business springs.

*Republication rights reserved by author.

Adding to Existing Loads—If a salesman is able to induce a customer to make a new application of electric power he should be given special credit. If he is merely able to sign a contract for an additional load which is installed in an extension of the customer's factory where private generation would not be economical, the salesman's credit should be somewhat less. In normal times there is a very considerable increase in power load added by existing customers with which the effort of the power salesman has little to do. He should know about these additions and assist in any way in having them made on a proper basis, but he should not depend on this class of business to justify the compensation that an experienced power salesman should receive.

Shutting Down Private Plants—The power company in any given location may already be serving a majority of the industrial load, but it is the exceptional territory that does not have one or more private plants of importance. A power salesman should realize that as long as there are any private plants left in his territory there is pretty sure to be something lacking in either his ability to convince these customers that they should buy power or to convince his own company that it should establish some basis on which power can be sold to these plants.

It sometimes happens that a salesman is able to shut down part of a customer's steam plant, particularly where the customer is interested in maintaining a satisfactory heat balance and where he is willing to buy that part of his power that is more costly than his average power. The salesman is probably entitled to all the credit he can get for obtaining part of such a prospect's load, but he should remember that in taking only a part he is making it more difficult, if not impossible, ever to get the balance. A policy too frequently followed is to serve part of a customer's load and provide standby service for the balance on the theory that half a loaf is better than none. If the standby charges are too low and are not made a very substantial part of the customer's cost in generating the bulk of his power it will be very difficult later to obtain the balance of the load.

It is quite often worth all the effort and expense involved to obtain a customer's entire load at the start rather than to try to bite it off piecemeal. If any special inducements may be offered they can more easily be justified on the basis of the entire volume of business than on part of it. When the situation is such that the customer can buy that part of his load which is expensive to generate and get the power company to stand in reserve for the rest of the load at a nominal cost, the salesman will find the going very hard when he tries to displace the generated portion of such a customer's load.

The credit given a power salesman for shutting down private plants, particularly the entire plant, should be at least equal to the credit given him for all other kinds of activity combined. The technique which a salesman must develop to be able to shut down private plants enables him more satisfactorily to combat the threats of private plants. Furthermore, his ability to shut down private plants is the one characteristic of the highly successful power salesman that differentiates him from

the ordinary salesman. A power sales department made up largely of men who have demonstrated their ability to shut down private plants deserves to be considered separately from the merchandising or lighting departments, and its work should not be circumscribed by being directed by men who have not had personal successful experience in shutting down private plants. Such men will not appreciate what it means to make a customer change his method of power production, and the power salesman will generally fail to find such a manager of much real help at critical stages of negotiations.

When a salesman has shut down a power plant that has been operating successfully for years he has accomplished something definite and desirable and probably of greater importance than any one other thing he could have done. For this reason too much emphasis cannot be placed upon the importance of a power salesman keeping on his toes in his efforts to eliminate *all* of the private plants in his territory.

New Customers—Some power salesmen have been particularly successful in securing new customers in new industries or new locations. Through co-operation with the utility's industrial development department, or when acting as such a department himself, the wide-awake power salesman can frequently induce industries to locate in his territory or even induce existing industries to establish branches or associated operations that will produce a power load for his company. There should be a place in the schedule of credits for real accomplishments along these lines.

Reports by Salesmen—In order to measure the actual effectiveness of a power salesman's efforts it is desirable to have some specific routine established for reporting his activities and accomplishments. These can be covered in the following procedure:

1. *Weekly reports* should include the names of all customers and prospects on whom the salesman has called, stating the object of the call, the results obtained and the present status of the negotiation. This report should not be aimed at accounting for the salesman's time by the clock or calendar, but toward the more specific and profitable purpose of showing what customers the salesman has contacted and what plans he has under way. It should indicate what steps the sales manager can take to be of assistance in the negotiations. The report will of itself indicate whether the salesman is spending too much time in the office or on existing customers and not enough time in developing new prospects and shutting down private plants.

2. *A monthly report* would show the nature and amount of all business signed, the nature and amount of business retained, the character of the new prospects uncovered and a summary of conditions in the salesman's territory. Properly to make out a monthly report the salesman should be able to show the contracts actually signed and the additional loads actually put on the lines as a result of his effort. This brings up to a third procedure, namely, that of the salesman's report of specific business contracted.

3. When a new customer is signed up, a new meter set and a new account opened on the ledgers it is generally a simple matter to report this business in a way which is self-explanatory, using existing company forms. When it comes to reporting additions to existing loads where no changes in meters or transformers are required and where no change in rate schedule is involved, it is frequently difficult to get an accurate idea of just how much business the salesman was responsible for. It is therefore difficult to give definite credit for such work on the official records of the power sales department. There may also be occasion to report a change in the basis for billing a particular customer, such as a change from secondary to primary metering or a change in the rate schedule, and some provision should be made for reporting this kind of work.

Notice of { Additional / New / Changed } Power Contract

Power & Light Co., Alma March 1, 1933.

To: General Manager

Customer: Acme Sand & Gravel Co.

Address: Corning, N. J.

		In Service	Additional	Total
Total connected load	{ Power / Light	357 Hp.	143 Hp.	500 Hp.
Estimated maximum demand		400 kva.		
Size transformers recommended		3-150 kva.		
Line extension required		None		
Cost to serve		$400		
Voltage of motors		440		
Voltage of metering		2,300		
Date service is wanted		July 1, 1933		

Details of contract

Signed 2/20/33 sent to district 2/20/33 attached.....

SCHEDULE "C"

Estimated annual revenue	$3,000 additional
Nature of customer's business	Sand and Gravel Pit
Prospective increase in load	Pump in 3 months — 50 Hp.
Electrical contractor	Wessel & Co.

Copies to:
Vice-Pres.
Genl. Supt.
Elec. Engr.
Meter Supt.
Rate Clerk
Billing Dept.
Power Sales Mgr.
Salesman
File

Send bills to: Acme Sand & Gravel Co
142 Beach St.,
Corning, N. J.

Remarks: Customer changing from secondary to primary metering.
100 Hp. engine shut down.

Submitted by:

Salesman | District Manager | Power Sales Manager

It is possible to cover all of these factors in one simple report such as that reproduced here. This form was first developed by C. W. PenDell, assistant to the vice-president, Public Service Company of Northern Illinois, and has been used by the writer and others for a number of years with entire satisfaction. The form is called a "Notice of Power Contract" and, as will appear, covers reporting *new* contracts, *additional* contracts and *changes* in contracts. The notice is made out by the power salesman and may be countersigned by the local superintendent in whose territory the customer is located. It is approved and distributed by the power sales manager. Copies of the notice are sent to all parties interested, such as meter superintendent, chief clerk, sales manager, etc. The exact amount and character of details included may vary with the difference in company organization and practice. Some of the outstanding advantages of this form are:

Definite authorization of credit to the power sales department for specific work accomplished.

Exact information on the nature of changes in the status of a customer or the requirements to serve a new customer.

Accurate information to the billing department to enable it to start the billing at the proper time and on the proper rate schedule.

Accurate information on the customer's existing load as well as the additional business signed.

An estimate of the annual revenue expected and the cost to serve the customer.

Information on additional prospective business. This information can be transferred to the active prospect list.

The name of the electrical contractor. This is of value to the meter and inspection departments in working out any problems that may arise on new wiring or changes in the customer's service.

Under "Remarks" the salesman may call attention to special features of the contract or give other information which will indicate the relative importance of this particular piece of business, such as "Steam Plant Shut Down," "New Industry," "Plant Expansion," etc.

Where such forms as this are used conscientiously it is possible for the power sales manager at the end of the month to bring together all reports of each salesman and from them to construct a comprehensive, fair and accurate picture of the accomplishments of the individual salesmen and of the department for that particular month. This is far better than depending upon the individual salesman's memory at the end of a month or year or whenever occasion arises to give an accounting of the accomplishments of the department. Report forms such as these assist in establishing a fair basis for comparison of the efforts of individual salesmen and of one power sales department with another.

▼

36,000,000 Kw. in Public Utilities

With their power equipment increased by 470,000 kw. during the year, public utility plants in the United States had an installed capacity at the end of 1932 of 36,060,593 kw. Of this total 34,010,137 kw., or 94.5 per cent, was in central stations, while plants for various other utility purposes comprised the remaining 5.5 per cent.

How this capacity is distributed is shown in further detail in the accompanying tables. There is also shown the corresponding allocation of output, including that part of the production of manufacturing plants which is sold and so enters into the public supply. The statistics are taken from a report by the Geological Survey, "Monthly and Annual Production of Electricity for Public Use in 1932," and, for comparison, from one of the tables in last year's report.

Table I—Capacity and Output, by Types of Plants, End of 1932*

Type of Plants	Companies	Plants	Capacity, Kw.	Output, Thousand Kw.-Hr.	Per Cent of Total Output
Central stations	1,431	3,720	34,010,137	77,868,294	93.7
Electric railways	32	43	1,146,180	2,441,712	2.9
Electric railroads	6	7	273,560	553,251	0.7
Bureau of Reclamation	3	10	36,390	144,506	0.2
Public works	11	15	357,050	1,194,019	1.4
Manufacturing	60	69	237,276	951,200	1.1
Totals	**1,543**	**3,864**	**36,060,593**	**83,153,082**	**100.0**

Table II—Capacity and Output, by Types of Plants, End of 1931*

Type of Plants	Companies	Plants	Capacity, Kw.	Output, Thousand Kw.-Hr.	Per Cent of Total Output
Central stations	1,455	3,746	33,483,821	86,663,186	95.4
Electric railways	32	46	1,129,460	2,106,898	2.3
Electric railroads	5	6	290,560	711,301	0.8
Bureau of Reclamation	6	16	95,690	242,236	0.3
Public works	7	9	297,250	754,838	0.8
Manufacturing	63	77	293,291	1,250,931	1.4
Totals	**1,568**	**3,900**	**35,590,072**	**91,729,390**	**100.0**

*Plants having an output of 10,000 kw.-hr. or more per month.

Table III—Public Utility Plants, by Type of Prime Mover, End of 1932

Division	Companies	Plants	Capacity—Total, Kw.	Water Power, Kw.	Steam Power, Kw.	Internal Combustion Engines, Kw.
United States	**1,543**	**3,864**	**36,060,593**	**9,725,096**	**25,847,184**	**488,313**
New England	146	331	2,940,867	814,517	2,118,430	7,920
Middle Atlantic	155	423	9,176,571	1,473,037	7,673,910	29,624
East North Central	300	682	8,238,629	643,200	7,564,513	30,916
West North Central	361	736	2,653,143	473,240	2,015,095	164,808
South Atlantic	165	442	4,315,180	1,885,620	2,379,564	49,996
East South Central	78	220	1,718,029	949,921	743,601	24,507
West South Central	132	422	1,715,049	85,515	1,504,786	124,748
Mountain	128	312	1,189,260	787,781	356,793	44,686
Pacific	78	296	4,113,865	2,612,265	1,490,492	11,108

During the year the number of reporting companies and number of plants both decreased slightly, the former presumably indicating a few new consolidations and the latter the gradual replacement of small plants by fewer larger ones. The quantities given in the tables are based on the operation of plants having an output of 10,000 kw.-hr. or more per month.

Of the total generator capacity, 26.9 per cent was driven by water power, 71.7 per cent by steam and 1.4 per cent by internal combustion engines. The proportions, however, vary widely in the different geographical regions. In the several states the variations, as shown by the Survey report, is still greater.

Reduction of output by 9 per cent compared with 1931, combined with the somewhat larger capacity, resulted in a decrease of the capacity factor from 29.4 per cent to 26.4 per cent in 1932.

▼

Minimum Profitable Energy Sales Price Defined

In the pending rate case against the Edison Electric Illuminating Company of Boston before the Massachusetts commission the petitioners recently requested the company to state at how low a price it can profitably sell electrical energy. L. S. Goodman, superintendent of the statistical bureau and one of the principal witnesses in the proceeding, co-ordinated the answer, which placed a figure of 2.03 mills per kilowatt-hour as the unit cost above which electricity might be marketed at a profit under proper conditions.

The company pointed out that under certain operating conditions an increment block of energy might be produced at its Edgar station which would involve both high- and low-pressure steam turbines already running partly loaded. Under such conditions no cost for bringing additional machinery into service and no boiler banking would be involved. With coal at $4.93 per long ton under the boilers this increment cost would be: Turbine increment, 1.58 mills; maintenance and supplies, 0.35 mills; allowance factor for complete coverage of costs, 0.1 mill; total, 2.03 mills. While any price offered above this cost would constitute a profit, no sale would result unless the specific profit appeared clear enough to make the transaction worth while, in the judgment of the interested parties (as the Edison and New England Power companies).

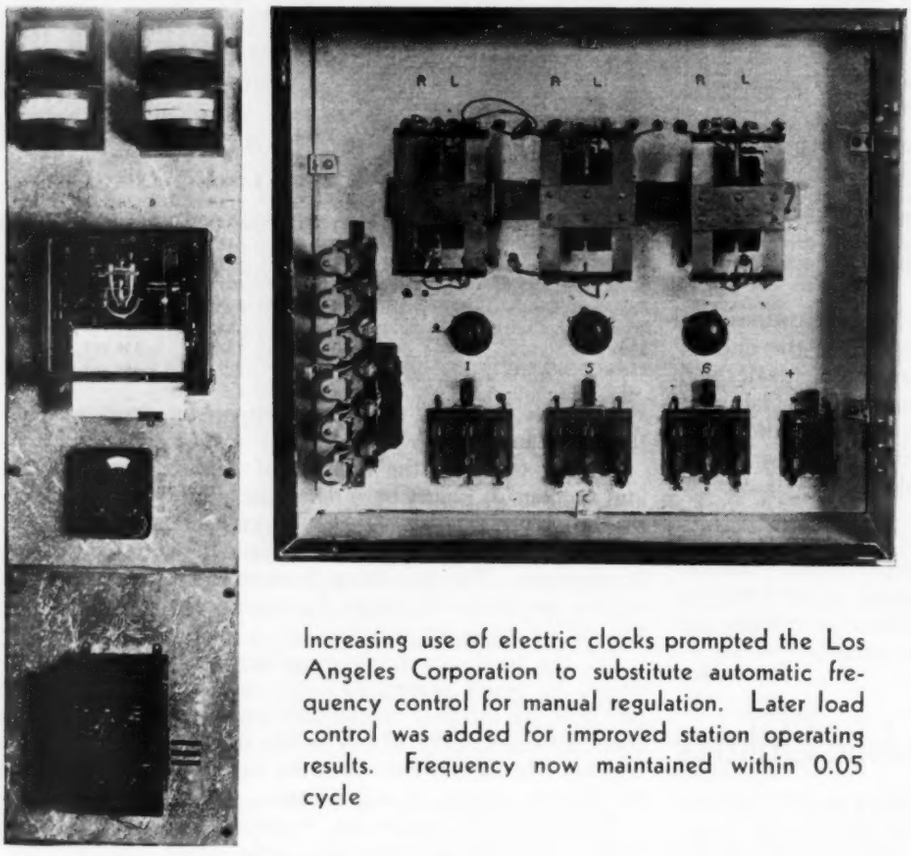


Fig. 1—Load and frequency control panel at Alameda Street steam station

Improving Service with Automatic Control

Increasing use of electric clocks prompted the Los Angeles Corporation to substitute automatic frequency control for manual regulation. Later load control was added for improved station operating results. Frequency now maintained within 0.05 cycle

THE installation of load and frequency control equipment in the Alameda Street station of the Los Angeles Gas & Electric Corporation was conceived solely for the purpose of improving service to the consumer.

Generating stations of this company include its Seal Beach steam plant with an installed capacity of 75,000 kw. and the Alameda Street steam plant, which has a capacity of 70,000 kw., three units therein, each rated 20,000 kw., generally being in use. Because of its higher efficiency Seal Beach is operated on base load, while Alameda Street takes the system load swings and serves as the regulating station.

Up until 1927 manual control was satisfactory in holding frequency well within commercial requirements. With the advent of talking motion pictures in studios supplied by the company close frequency regulation was of major importance to this class of customer and, to a lesser extent, to those consumers then using electric clocks. Anticipating a widespread growth in the use of the last-mentioned appliance, the utility installed a Warren Telechron master clock, which was checked hourly with Western Union. Subsequently a Leeds & Northrup frequency recorder was installed to aid the operator in regulating frequency. This led to the installation of an automatic frequency controller, which enabled Telechron time to be maintained within two seconds of the master clock. The frequency control installation was then supplemented with a recording master clock, which enabled time regulation within one second during normal operation. As this regulation was closer than could be maintained with the master clock, a short-wave radio set was installed, with which the master clock was checked twice a day with government time signals.

The installation has been in operation for more than a year and has provided regulation which does not exceed 0.05 cycle deviation. The controller utilizes an impedance bridge for the frequency measurement and a proportionate contacting galvanometer for the control. The latter transmits through relays corrective impulses to the turbine governor motor when frequency begins to deviate from the desired point by as much as 0.01 cycle.

Originally the control impulses were sent to a single

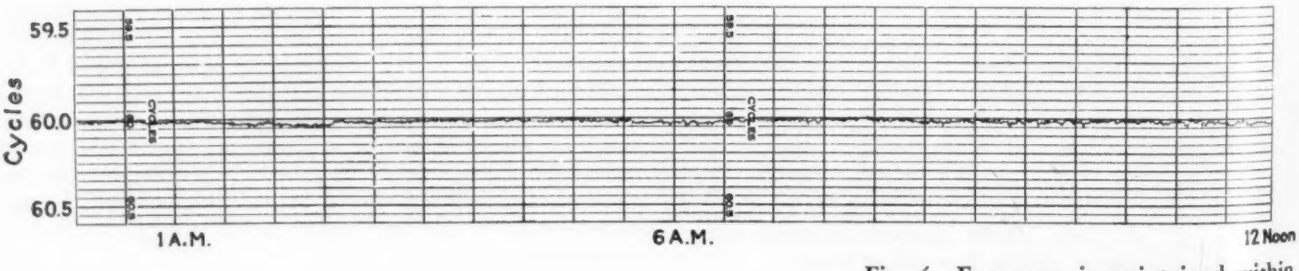


Fig. 4—Frequency is maintained within

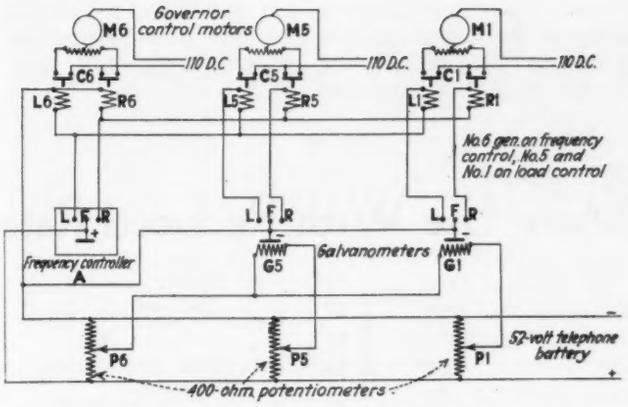


Fig. 2—Schematic diagram of the load and frequency control

Load division is accomplished by the relation between the throttle opening of each of the three machines, the positions of *P*-1 and *P*-5 and *P*-6 depending upon the throttle cam positions of their respective units. Potentiometer slide wires (*P*-1, *P*-5, *P*-6) are mounted on the valve camshaft of each turbine and are consequently positioned within fairly close limits to correspond to generator load. One generator, No. 6, in Fig. 2, is selected to operate as the pilot unit and is connected directly to the frequency controller. The potential between one end of generator No. 6 potentiometer slide wire and its moving contact is compared to the corresponding potentials of the generator slide wires *P*-5 and *P*-1, through contacting galvanometers *G*-5 and *G*-1. As long as generators Nos. 5 and 1 carry the same load as pilot generator No. 6 the galvanometer contactors are in their neutral position. Should their loads be higher or lower than the pilot generator, then the galvanometer contactor closes correspondingly to the *L* or *R* positions. Impulses originating in the frequency controller will then operate on the governors of units Nos. 5 and 1 if they are in such a direction as to equalize the loads of the latter generators with generator No. 6.

unit and periodically the load on the remaining generators in operation was manually readjusted to maintain suitable over-all load distribution. It was felt that it would be desirable to permit all three of the generators which are usually in service to participate equally in frequency regulation and an attempt was made to send impulses from the frequency controller simultaneously to all three governor motors. Experience showed that this arrangement was not entirely satisfactory, since after a brief period of operation the unequal characteristics of the three governors would cause the loads on the units to pull apart and manual readjustment was necessary. At this time an additional load-balancing feature was added which permits all three generators to participate in frequency regulation, but in such a manner as to avoid unequal loading on the generators.

Automatic load balancing is obtained at the same time that frequency is regulated by means of the circuit shown in Fig. 2. The net result of this arrangement is that at least one generator will respond to the frequency con-

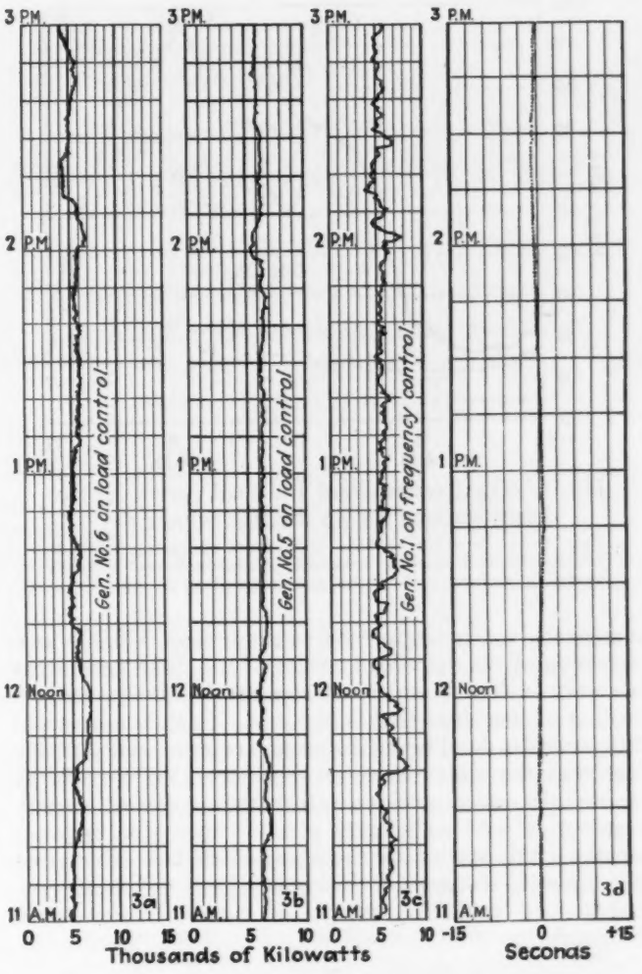
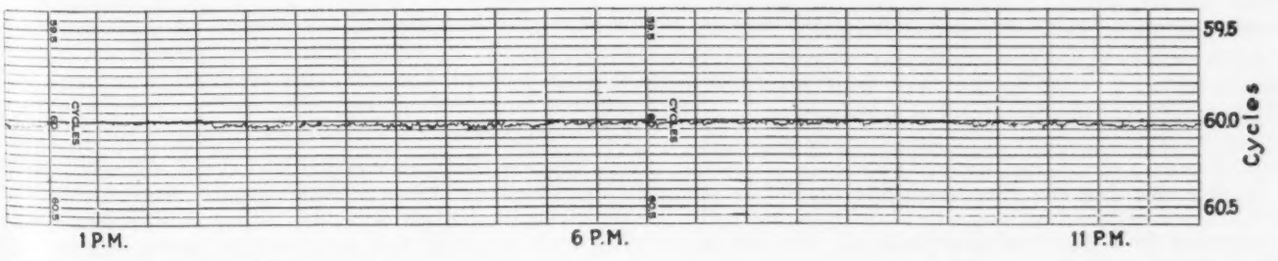


Fig. 3—a, b, c, d—Load and integrated time charts for December 28, 1931, from 11 a.m. to 3 p.m.

On the left are load charts for units Nos. 5 and 6, operating with load control, in conjunction with unit No. 1, operating with frequency and load control. Chart 3c shows that as load swings and frequency correction are taken on unit No. 1, the two other units follow major load changes with relatively small variations. Integrated time, shown on the right (3d), shows a maximum deviation of a half second, which was immediately corrected.

troller and the other generators will also respond if the impulses are in such a direction as to maintain equal loading on all three machines. In this way close frequency control is obtained and at the same time loads on generators in service are kept equal, within substantially close limits.

Total system connected load is approximately 335,000 kva. and during periods of tie with the Southern Sierras Power Company over a 30,000-kw. line the total inter-



0.05 cycle during the 24-hour period

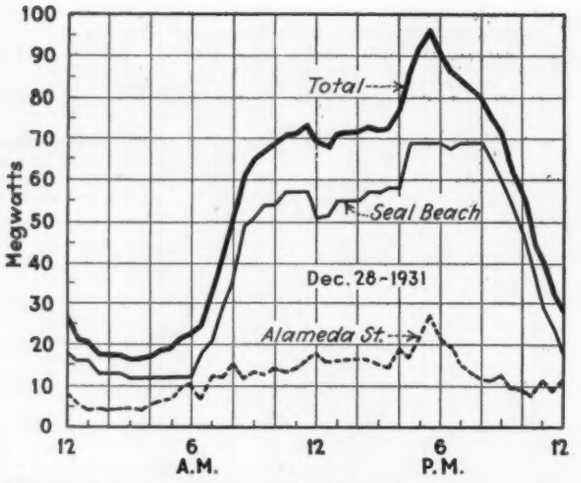


Fig. 5—Total system load and load curves on two steam stations for an average winter day

Seal Beach station carries base load operating with a pre-established loading schedule, Alameda Street station carrying swings and peaks and regulating frequency.

connected load is augmented to more than 500,000 kva. A section of the daily load curves of the three generators is shown in Fig. 3 and illustrates the relatively uniform loading of machines that is obtained. Such fundamental differences in loading as do occur are due chiefly to the fact that the slide wires are positioned on a basis of steam inlet valve settings rather than kilowatt output. Loading is held sufficiently close to meet tne requirements of this station by the above-described valve position scheme, although division on a basis of actual generator load could be utilized if closer division were necessary.

▼

Extinguishing Internal Transformer Fires*

A 40-gal. soda-acid chemical engine on wheels, equipped with a curved pipe that may be inserted in any opening in a transformer, constitutes the means still used for fighting internal fires in old type transformers having an air space above the oil, according to G. S. Diehl, assistant to superintendent of operation Pennsylvania Water & Power Company, and W. T. Crook, Jr., testing engineer Safe Harbor Water Power Corporation.

This method was successfully used in extinguishing a fire that originated in the internal connection board of a 10,000-kva., 70/11-kv. transformer, in which the flames shot more than 20 ft. into the air. The fire was extinguished in a few seconds and only about 15 gal. of liquid was required. Subsequent tests of similar fires proved that CO_2 gas would have been equally effective.

After repairing the terminal board, clearing out loose copper particles, washing the core with fresh oil and filtering the transformer oil the transformer was returned to service, where it remained until replaced six months later.

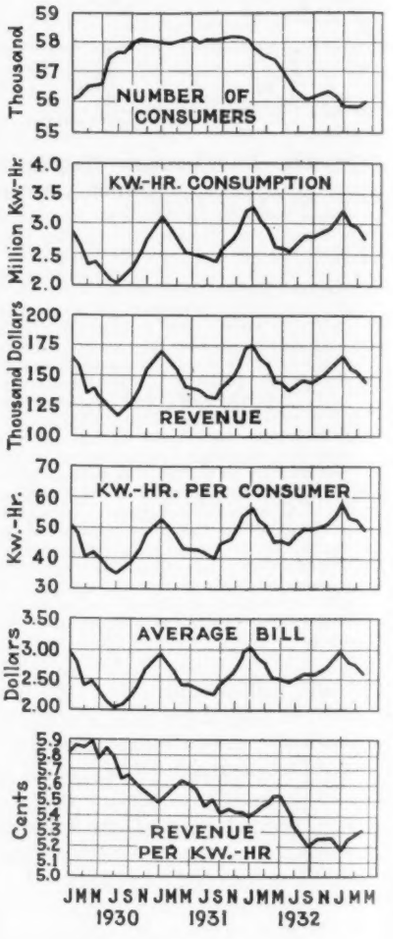
During this fire the core remained under oil at all times. Had the drain valve been opened and the oil level dropped the transformer would have been permanently damaged. This point is important in coping with transformer fires, these engineers emphasize.

Extracted from paper receiving James H. McGraw second prize in contest under N.E.L.A.-E.E.I. auspices.

▼

More Use With Reduced Rate

In Dallas, Tex., the number of residential customers for electric light and power decreased somewhat during the past year, as it did in many other cities. Nevertheless, consumption has on the whole been rising, especially in the summer months, yearly revenue has been holding up well, consumption per customer continues on an upward trend and the average bill is appreciably larger and more uniform each year.



With gradually decreasing rates a gain in energy consumption is not surprising. But it is worth noting that the yearly revenue per customer has also continued to increase. This increase has been coming in the summer months. The winter maximum has varied but slightly.

The smoothing of the yearly fluctuations points quite clearly to an improvement in the appliance load, encouraged by a rate structure favoring large use.

The accompanying charts were compiled from reports filed for public record in the office of the Supervisor of Public Utilities by the Dallas Power & Light Company, by R. C. Burleson, engineer to the supervisor, who writes as follows:

"On December 16, 1929, the rate was changed from 6 cents net per kilowatt-hour to an optional rate of 6 cents net per kilowatt-hour for the first 8 kw.-hr. per room per month (five rooms minimum), 4 cents net per kilowatt-hour for the next 100 kw.-hr. and 2 cents net per kilowatt-hour for the excess; minimum bill, 50 cents.

"On August 6, 1932, the 6-cent block was reduced to $5\frac{3}{4}$ cents, all of which accounts for the downward trend in 'Revenue per kw.-hr.' In Dallas natural gas, which has been available for a number of years, is generally used for cooking and water heating."

Asphalt Emulsion Reduces Insulator Radio Troubles

By F. O. MCMILLAN
Research Professor in Electrical Engineering, Oregon State College

Treating head, tie wire groove and pinholes with insulating compound proves effective and practical way of minimizing radio interference.

LABORATORY tests at Oregon State College show that asphalt emulsion properly applied on the conventional types of high-voltage insulators, now in service, will very greatly reduce the radio interference they produce. The best results are obtained with asphalt emulsion, or any treatment applied for the purpose of eliminating radio interference from insulators, when care is exercised in the application of the material. The methods of application described below have been found satisfactory for treating the pinholes and heads of insulators.

Defective insulators, particularly those with one or more cracked shells or with loose cement between shells, are usually only slightly improved, if changed at all, by the application of asphalt emulsion or any other treatment. Therefore all insulators should be carefully inspected before treating and those that are found to be defective should be replaced with good units.

Treatment of insulator pinholes that are not equipped with metallic thimbles cemented in place is very important. Insulators with metallic thimbles carefully cemented in place do not usually cause very serious radio interference from electrical discharges in the pinholes at normal operating voltage. Malleable thimbles for ¾-in. pin threads are in general better than the pressed metal thimbles for larger threads because the total diameter is smaller and the clearance between the metal and the porcelain of the insulator over the surface of the cement is greater, therefore the voltage gradient imposed on the air in that region is less. The sharp edges of pressed metal thimbles sometimes cause interference because of dielectric flux concentration and corona formation on them.

The radio interference characteristics of an insulator fitted with any type of metallic thimble is usually very much improved by carefully filling the pinhole with cement to a point flush with the end of the thimble. This precaution avoids a short air gap in the region of high dielectric flux density between the exposed end of the thimble and the surrounding porcelain shell. When the air in such a gap is not displaced with cement or some other compound it will cause radio interference at a comparatively low voltage.

Insulators with porcelain or glass threads that are not treated in any way to make the surface conducting cause very serious radio interference at very low voltage because of the electrical discharges accompanying the ionization of the air between the pin and the insulating material. For this reason insulators with threads formed in the untreated insulating material should not be used in locations where the elimination of radio interference is an important consideration. Pins with lead and various kinds of spring threads are not effective in eliminating the radio interference caused by such insulators because they do not displace all of the air in the pinhole between the pin and the insulating material, and at any given insulator voltage this gas is subjected to practically the same voltage gradient regardless of the construction of the pin.

Displacing all of the air in the pinhole with an insulating compound that is dielectrically strong enough to withstand the maximum voltage gradient to which it is subjected in service eliminates the radio interference from that source. The air may be displaced by removing the insulator from the pin and carefully coating the entire surface of the pinhole and the threads of the pin with asphalt emulsion; a small excess of emulsion should be

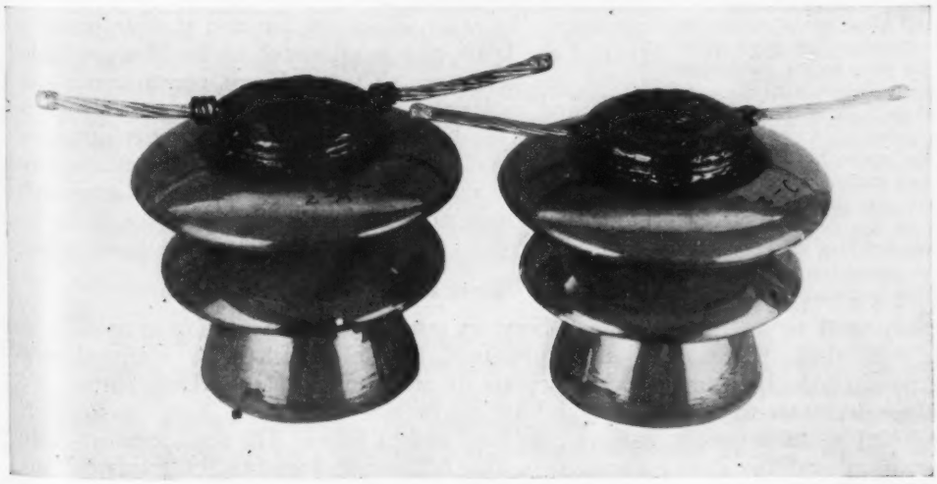


Fig. 1—Asphalt emulsion averts radio interference

After fifteen months exposure to weather and rated voltage the luster of the deposit is dimmed, but the corona-forming voltage is not found to be measurably reduced.

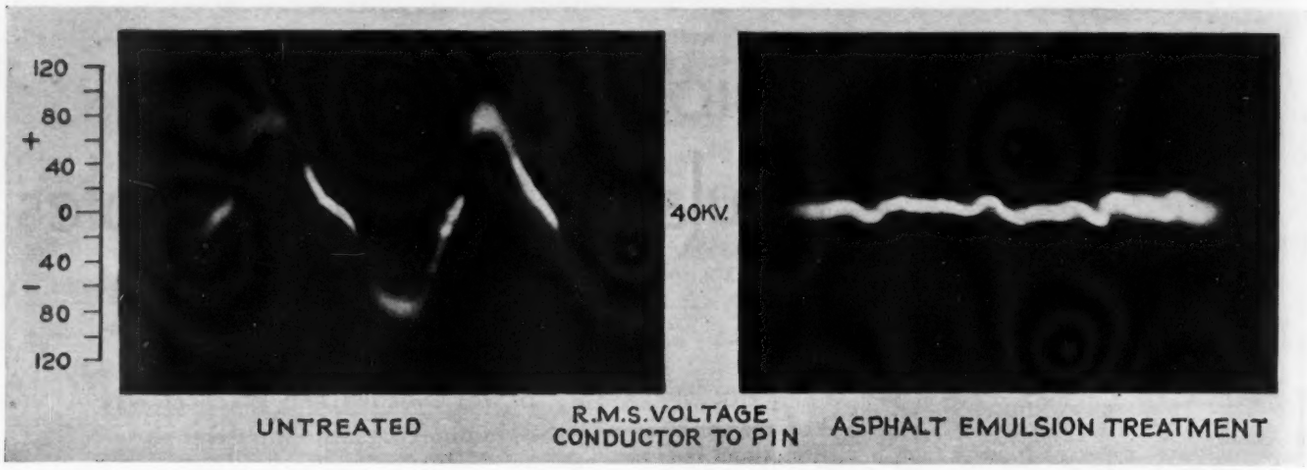


Fig. 2—Corona current cut 90 per cent by asphalt coating

66-kv. insulators with 40-kv. r.m.s. applied conductor to pin at 19 deg. C and 3.8 per cent relative humidity.

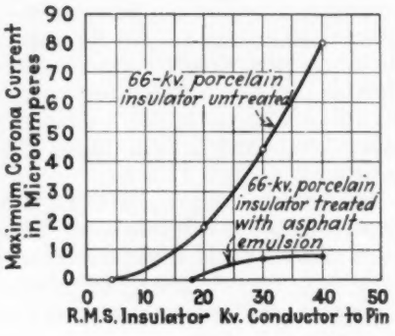


Fig. 3—Corona-forming voltage raised materially and current substantially reduced

left in the pinhole to insure filling the voids; the insulator is then screwed home on the pin and the excess emulsion that is forced out around the pin removed.

Treatment of insulator heads in detail

The conductor and tie wire are removed from the insulator, the head wiped clean, the conductor and tie wire grooves coated with a thick layer of asphalt emulsion, the conductor coated with the material for a distance equal to slightly more than the length of the conductor groove in the insulator and then tied on the insulator with a very tight tie. This method of applying the treating material allows the conductor and tie wire to embed themselves in the asphalt emulsion and eliminate the thin air films in the dielectric field between the conducting materials and the insulator surface. The coating applied on the conductor where it is in contact with the insulator fills the voids between the cable strands and still further insures the elimination of gas inclusions in the regions of high-voltage gradient.

The ends of the tie wires are snipped off close to the conductor except when "live-line tools" are used or when for some other reason it is undesirable to cut the tie wire close to the conductor. In such instances the tie wire may be cut to length with the ends turned back in closed loops approximately 1 in. in diameter to prevent them forming corona-discharge points.

After the conductor is tied in place the entire head of the insulator is covered with a layer of asphalt emulsion, from $\frac{3}{16}$ to $\frac{1}{4}$ in. in thickness, and extending out on the top shell a distance of approximately $1\frac{1}{4}$ in. from the bottom of the tie wire groove. Particular care must be exercised to insure filling the conductor and tie wire grooves around and over the conductor and tie wire. An insulator treated with asphalt emulsion is shown in Fig. 1.

In areas where insulators are subjected to salt fog deposits, excessive contamination with dust, portland cement or other conducting or partially conducting materials the surface insulation resistance decreases to very low values. When insulators subjected to such conditions are treated with asphalt emulsion and the conductor and tie wire are entirely incased in the insulating material the asphalt coating over the tie wire is subjected to practically the entire conductor-to-pin voltage due to the insulator surface conduction. In the case of the higher-voltage insulators this voltage will puncture the asphalt. Since the asphalt is somewhat self-healing successive discharges through it will occur at intervals controlled by the insulator surface conditions. These discharges cause serious radio interference if permitted to occur, and when asphalt emulsion is used under conditions of serious insulator contamination it is recommended that tie wires of not less than No. 4 A.W.G. be used. After the normal insulator treatment is completed the emulsion should be scraped away to bare the outer surface of the tie wire in four places, from 1 to 2 in. long, equally spaced around the head of the insulator. Uncovering the tie wire in this manner permits the surface conduction to take place without puncturing the asphalt and it does not materially decrease the effectiveness of the treatment in eliminating the corona discharges between the tie wire, the conductor and the dielectric of the insulator.

An excellent grade of asphalt emulsion suitable for treating insulators can be purchased for 57 cents per gallon in 55-gal. drums. Approximately $\frac{1}{2}$-pint of emulsion is required to treat a 66-kv. insulator, and allowing a 10 per cent waste during application the material cost is slightly less than 4 cents per insulator. The labor cost for applying the emulsion on the heads of insulators, from available data, is estimated to be 30 cents per insulator. In cases where the pin and pinhole must be treated the labor cost is estimated to be 10 cents additional per insulator. The total cost per insulator for labor and material is therefore approximately 34 cents for treating the head only and 44 cents for treating the head and pinhole. These labor cost estimates are considered to be maximum values and it is believed that skilled workmen, after gaining some experience, will very materially reduce the labor items below the values given.

Tests show success of treatment

The laboratory tests on asphalt emulsion were made on treated insulators, half of which were equipped with 20-in. sections of aluminum cable steel reinforced and aluminum tie wires and half with 20-in. sections of copper conductor and tie wires. The test specimens were prepared in this manner to preserve the treatment and

make it possible to take the insulators directly from the radio interference tests to the life tests without retreating them. Both aluminum and copper conductors and tie wires were used because it was necessary to determine from the weathering tests whether the conductor and tie wire material had any influence on the life of the compound. The insulator samples used were treated on the head only because they had metal thimbles cemented in the pinholes and were therefore fairly free from corona at the pin.

An investigation of the visible corona on treated insulators showed that those treated with asphalt emulsion had higher corona-formation voltages than any of those treated with the many other kinds of materials investigated and in every instance the corona formed at some other point on these insulators before it formed on the head where the asphalt emulsion was applied.

Cathode-ray oscillograms were taken of the corona current for 66-kv. porcelain insulators of conventional design both with and without asphalt emulsion treatment to determine in a quantitative way the effectiveness of this treatment for preventing corona discharges on insulators and eliminating the resulting radio interference. The electrical circuit used in taking the oscillograms was a bridge type developed to eliminate the charging current from the corona current measurements and its use makes it possible to either visually observe or photographically record the corona current independent of the insulator charging current.

The cathode-ray oscillograms in Fig. 2 show the corona current for a 66-kv. porcelain insulator without treatment and for the same type of insulator with asphalt-emulsion treatment at r.m.s. conductor to pin potentials of 10, 20, 30 and 40 kv. (The equivalent three-phase line voltages are 17.3, 34.6, 52, and 69.3 kv.) These oscillograms show the very marked reduction in corona current effected by the application of asphalt-emulsion treatment.

Data were obtained from the cathode-ray oscillograms shown in Fig. 2 for plotting the maximum corona current in microamperes as a function of the insulator voltage for both the untreated and the asphalt-emulsion treated insulators. The graphs in Fig. 3 show that the asphalt-emulsion treatment on the head of the insulator reduced the maximum corona current to 10 per cent of the value obtained with the untreated insulator. These results are pessimistic rather than optimistic, because a large part of the corona current that remained after the head of insulator was treated was due to corona around the metal thimble in the pinhole where no treatment was applied. This fact is confirmed by observations which showed that corona occurred around the thimble in the pinhole of the treated insulator at 18 kv., which is 20 kv. below normal operating voltage. The treated insulator used for the comparative measurements of the corona current with the cathode-ray oscillograph was selected because it had the lowest corona-formation voltage, on both the head and in the pinhole, of all the insulators treated with asphalt emulsion and therefore the results obtained represent the minimum improvement to be expected from this treatment.

Radio interference measurements made with a Western Electric field strength measuring set indicate that the asphalt-emulsion treatment reduces the radio interference produced by a 66-kv. insulator, at normal operating voltage, to a value ranging between 3 and 10 per cent of that produced by an untreated insulator of the same type.

These measurements show that asphalt emulsion is very effective in mitigating the radio interference from high-voltage insulators.

Life tests are in progress on various kinds of materials that show promise of proving valuable for treating insulators in service.

Six power companies in various parts of the United States have either already treated the insulators on some high-voltage lines or will in the very near future. One of these companies is on the Atlantic seaboard, two are on the Pacific and three are inland in regions of different climatic conditions. Valuable data on asphalt-emulsion insulator treatment should, therefore, soon be available from actual service under widely different climatic conditions.

▼

Increment Power Definitions

Further definitions of items entering the economic determination of energy interchange problems were recntly introduced into the Boston Edison Company's rate case by F. M. Ives, counsel for the utility, in connection with exhibits discussed by L. S. Goodman, superintendent of the statistical bureau of the company. In view of the general interest operating engineers have in interconnection and increments of cost, these added definitions are given below:

Inadvertent Power—This is power exchanged without intention when there is no deliberate exchange called for. It often occurs in a small reversal of flow before or after a deliberate exchange, and also at times when the line is in service and no exchange is called for.

Increment Cost Details

In all transactions involving interchange power Boston Edison's unit costs are made up potentially for the same items as listed in what follows. Some of these items are not present in some transactions. The so-called banking factor and the (general) "factor" items may be either positive or negative algebraically. The terms have not been fully standardized, as in the case of "Turbine slope" and "Turbine increment," which mean the same thing.

Turbine Primary Increment—This is the cost of coal per kilowatt-hour in mills to supply the steam required for the increase of load on the (Edison Company's) 350-lb. pressure unit from zero to the limit of loading when the secondary valve begins to open.

Turbine Secondary Increment—This is a similar cost unit when both primary and secondary valves on the 350-lb. unit are open, due to greater loading. Secondary increment is larger than primary increment.

High-Pressure Turbine Increment—This is similar cost unit on the 1,200-lb. unit.

No Load Loss—No load loss is the cost of coal to supply the steam required to operate an idling turbine (without load), divided by the amount of increased or decreased manufactured output due to the transaction. The no-load item is applied only when putting in or taking out of turbines is made necessary by the transaction.

Banking Factor—This is the total cost of coal for banking boilers, which is either used or saved as a result of the transaction, divided by the amount of power interchanged, and expressed in mills.

Factor*—This item is a fixed factor of 0.10 mills dictated by experience to allow for miscellaneous items which cannot be figured in a practical way without excessive operating data. This unit includes various station losses, station use, and sometimes interstation line losses.

Maintenance and Supply—This is the cost of maintenance and supply per kilowatt-hour in mills for all items of maintenance and supply which increase or decrease with increase or decrease of load.

**Referred to above as general factor*—EDS.

Metallic Transformer Paints Cut Capacity in Winter

By E. A. CHURCH

Electrical Engineering Department
Edison Electric Illuminating Company of Boston

WHEN operating in bright sunlight in summer, published data indicate that different types of paint produce no appreciable differences in temperature rise of power transformers.* This is what might be expected since the intensity of the sun's rays on a hot summer day is of the same order of magnitude as the intensity of heat radiation from an average transformer. Differences in heat emissivity of various types of paint would have very little effect on the temperature rise when operated in bright sunlight since the coefficient of heat emissivity of a material is usually approximately the same as the coefficient of absorption. The surface effects will hence tend to neutralize each other.

Power transformers in northern climates generally operate in the shade or after dark during the periods of heaviest load. On account of lack of published data under these conditions, it was considered desirable to make some tests on two power transformers of as nearly identical characteristics as it was possible to obtain at the same location on the Edison System.

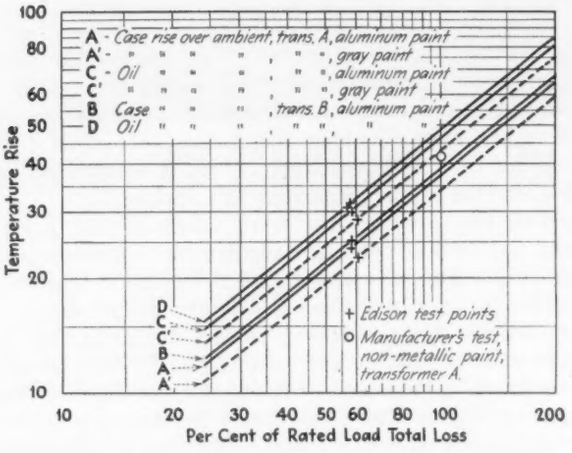
The transformers were equipped with oil temperature indicators and a mercury thermometer was placed against the transformer case on the shady side with the bulbs covered with putty to minimize the effect of air temperature on their registration. Readings of load, oil and case temperatures were taken every hour for about three weeks during November and December to determine if there was any difference in the heat dissipating ability of the two transformers when both were covered with aluminum paint. The test was then repeated after one transformer had been covered with a coat of gray paint with a non-metallic base. Weather conditions were recorded throughout the tests.

To determine the winding rise over oil the manufacturer's test data were used, no accurate method being feasible for determining it in the field. The average results of the two tests are given in the accompanying illustrations. There was not enough difference in the results between daylight and darkness and different kinds of weather to draw accurate quantitative conclusions, so in determining the decrease in load necessary to maintain equal temperature rises with aluminum paint as with gray paint the average temperatures and load for the complete tests were used.

The following conclusions can be drawn from the results of the investigation:

1. Aluminum paint can be expected to increase the temperature rise above ambient of the winding of the average power transformer, under the usual winter

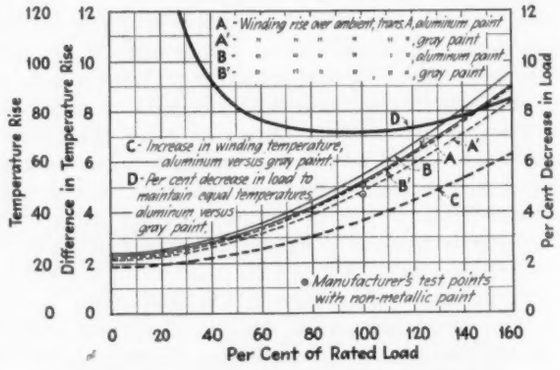
*"*Effect of Color Tank on the Temperature of Self-Cooled Transformers Under Service Conditions," by L. Wetherhill and V. M. Montsinger, A.I.E.E. Transactions, Vol. 49, 1930, page 49.*


A - Case rise over ambient, trans. A, aluminum paint
A' - " " " " " " , gray paint
C - Oil " " " " " , aluminum paint
C' " " " " " " , gray paint
B Case " " " , trans. B, aluminum paint
D Oil " " " " " "
Temperature Rise
100
80
60
50
40
30
20
10
D
C
C'
B
A
A'
+ Edison test points
o Manufacturer's test, non-metallic paint, transformer A.
10 20 30 40 50 60 80 100 200
Per Cent of Rated Load Total Loss

Oil and case temperatures with aluminum and gray paint

The oil temperature rise of a transformer can be shown to be represented by the following equation:
$T = T_o (W/W_o)^{0.80}$
where T_o = oil temperature rise at full load.
W_o = total iron and copper loss at full load.
T = temperature with total losses of W.
An equation of the same form is used to compute the winding temperature rise over oil at any given load when the rise at any load such as full load is known.
The rating of each transformer in this test is 3,500 kva. oil cooled and the voltage ratio 13,800 delta to 4,150 wye. The manufacturer's test data are as follows:

		Transformer A	Transformer B
Impedance, per cent		3.86	4.00
Iron loss, watts		17,520	17,720
Copper loss, watts		24,200	25,600
Temperature rise	Oil	41.3	45.0
at rated load, deg. C.	Copper	46.6	51.0



Winding temperatures with aluminum and gray paint

Curve C is the average vertical difference between curves A and A¹ and curves B and B¹, and curve D is the average horizontal difference between them. Transformer B was not actually tested with gray paint, curve B¹ being drawn with the assumption that the differences between the temperature rises of the case and oil of the two transformers were equal. The transformers were of similar construction, making this assumption reasonable. An excellent check is seen to exist between the winding temperatures at full load with gray paint, when computed from the data obtained in this test, and the manufacturer's test data taken before the transformers left the factory.

weather conditions, in the temperate zones about 7 per cent and decrease its full load rating by approximately 7 per cent on the basis of continuous loading.

2. The effect of sunlight on the temperature difference between aluminum and gray paint is very small in winter when the sun is low in the sky.

3. The effect of changes of ambient temperature have greater effect at moderate loads than the load cycle on the oil temperature of a large transformer.

4. Snow and rain have quite an appreciable effect in decreasing the temperature difference between aluminum and gray paint since the proportion of heat being radiated to that dissipated by convection and conduction is decreased.

▼

Prevention of Pitting in Stand-by Boilers

A survey of pitting conditions in the boiler plants of thirteen New England central stations was recently completed with the object of ascertaining desirable practice to prevent corrosion in stand-by service. Only two plants reported serious corrosion, although eleven had some pitting. In most cases the pitting was confined to the drums, only two cases reporting tubes affected. About half the plants have tried, or are still using, protective paint in drums, and none claim 100 per cent protection due to its use. The general opinion was that the paint offers some protection, but owing to the practical impossibility of obtaining an absolutely clean metallic surface before applying the paint some pitting will go on under the paint. The working pressures of the boilers were 200 lb. in eleven cases and 275 lb. in the others.

Six companies definitely charge corrosion to free oxygen. The water is deäerated before being fed to the boilers in six companies before stand-by and the same number attempt to drive off oxygen by boiling in the unit before stand-by. Nearly all the plants use soda ash, caustic or phosphate to maintain an alkalinity in the boiler varying from 4 to 50 grains per gallon. In only three cases is there a pH (hydrogen ion concentration) test of the water in the boiler made and used as an anti-corrosion guide. One company reported satisfactory results from electrolytic means of prevention. Ten plants fill the boiler to the working level before stand-by.

Six plants report periodic tests of water in stand-by boilers for corrosion control. In the two plants with the most severe corrosion one station has found that careful pH control, together with the use of a phosphate buffer solution, appears to have solved the problem. In the other case extensive experiments over a two-year period using protective paint as well as soda ash to maintain a definite alkalinity resulted in the conclusion that neither method was effective. Difficulties were encountered in maintaining the desired alkalinity and in obtaining representative water samples due to lack of uniformity of water in different parts of the boiler.

The majority opinion was that the only certain preventive of pitting and corrosion is to empty the boiler, dry it out and keep it ventilated, possibly with use of pans of lime in the drums to absorb moisture.

One company (Fall River Electric Light) reported excellent results from chemical treatment of the boiler water to produce a solution having a pH value of eleven and containing a buffer salt to protect the boiler surfaces from corrosion. In preparing boilers for stand-by service where the water used is not deäerated it was found necessary to operate the boilers for a period of about 24 hours to remove adhering bubbles from the metal surfaces and to make certain that the water was in proper chemical condition. As an added protection to areas where bubbles may adhere, a phosphate film maintained on the metal surfaces has proved valuable. This company states that it is essential that there be no possible chance of dilution of boiler water after the boiler has been removed from the line and pronounced in satisfactory condition from the chemical standpoint. Leaky non-return valves will cause a reduction in the pH value. As long as the pH value exceeds 9.6 and oxygen remains dissolved in the water, no particular deleterious corrosion will occur. Leaky blow-down and water column valves will reduce the water level and invite corrosion of uncovered wetted surfaces.

At the station in Fall River fourteen boilers are installed, operating at 160 lb. Feedwater is of exceptionally good quality. Surface condensers are used with about 10 per cent make-up. Under the present system of operation raw water is used entirely in the boilers. Before placing boilers in stand-by service they are treated with soda ash and phosphate and operated either for 24 hours or until the pH value is eleven and the phosphate content is 50 parts per million. Boilers have been allowed to stand for six months filled with water. Weekly tests are made on the water from each boiler, although these are unnecessary if boilers are maintained tight. Inspections at the ends of these periods have not disclosed the slightest sign of active corrosion.

The Stamford (Conn.) Gas & Electric Company installed an electric system of corrosion prevention in six stand-by boilers in April, 1932. These are kept ready for service with two gages of water in each and are fired up every 90 days. They are then shut down as active banked boilers on full pressure, but with very little steam generated. The boilers are opened and inspected every

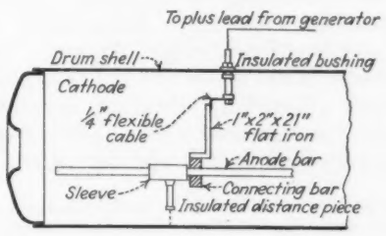


Fig. 1—Method of introducing positive potential into boiler drum at Stamford

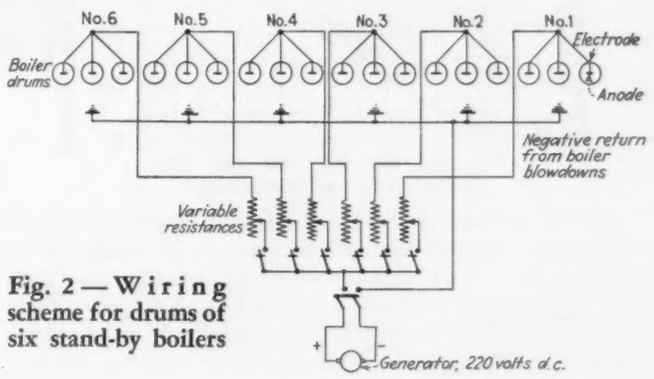


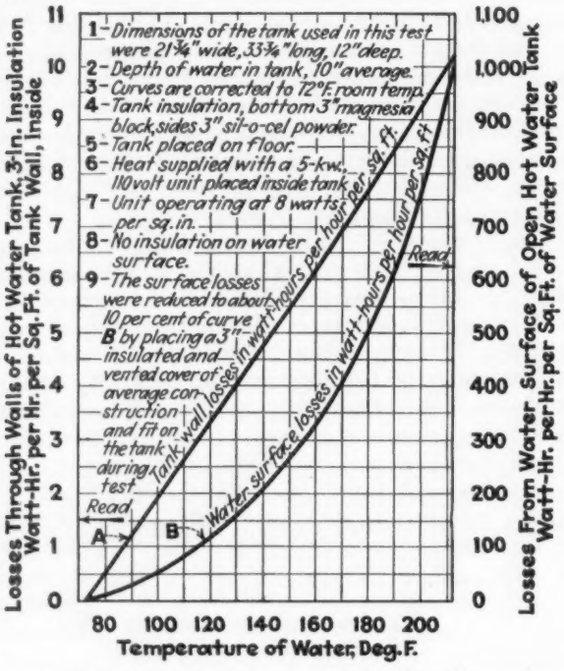
Fig. 2 — Wiring scheme for drums of six stand-by boilers

three months. Each drum is equipped with four soft steel bars 1¾ in. in diameter running longitudinally through the drum and carried on insulating supports. Direct current positive potential at 22 volts from a motor-generator set is introduced into the drum through an insulated bushing and connection made as shown to the steel bars, which act as anodes. The boiler shell serves as a cathode and the negative connection is completed through the blow-off piping to the generator as indicated in the wiring diagram. The drop through the boiler drum water is about 20 volts, leaving 2 volts from shell to ground. The current utilized to prevent corrosion is about 20 amp.

Since the completion of the investigation the Stamford company stated to a representative of the ELECTRICAL WORLD that the anodes have to be renewed about every twelve to eighteen months, depending upon the amount of current used. The basic principle in making the boiler shell serve as the cathode is served by introducing the steel bars into the drum as anodes. Boiler scale is largely composed of carbonate and sulphate ions. These pass to the anode, which is slowly consumed and which is replaced from time to time without much difficulty. The calcium and sodium ions pass to the boiler and keep the tube surfaces free from corrosion or scale. To July 11, 1933, the company had not observed any corrosion or pitting in these boilers. Formerly drums of banked boilers had to be cleaned every three months.

▼

Heat Losses from Open Hot-Water Tank


1-Dimensions of the tank used in this test were 21¾" wide, 33¾" long, 12" deep.
2-Depth of water in tank, 10" average.
3-Curves are corrected to 72°F. room temp.
4-Tank insulation, bottom 3" magnesia block, sides 3" sil-o-cel powder.
5-Tank placed on floor.
6-Heat supplied with a 5-kw., 110 volt unit placed inside tank.
7-Unit operating at 8 watts per sq. in.
8-No insulation on water surface.
9-The surface losses were reduced to about 10 per cent of curve B by placing a 3" insulated and vented cover of average construction and fit on the tank during test.
Tank wall losses in watt-hours per hour per sq. ft.
Water surface losses in watt-hours per hour per sq. ft.
Read
A
B
Losses Through Walls of Hot Water Tank, 3-In. Insulation Watt-Hr. per Hr. per Sq. Ft. of Tank Wall, Inside
Losses From Water Surface of Open Hot Water Tank Watt-Hr. per Hr. per Sq. Ft. of Water Surface
0 1 2 3 4 5 6 7 8 9 10 11
0 100 200 300 400 500 600 700 800 900 1,000 1,100
80 100 120 140 160 180 200
Temperature of Water, Deg. F.

When industrial processes require location of open hot-water (or hot-liquid) tanks where it would be expensive to run and maintain steam lines for keeping them hot electric heat provides a solution. To aid in calculating the radiation losses that must be offset by the electric heating element the General Electric Company has prepared the accompanying curves based on tests conducted under the conditions mentioned. The water-surface losses indicated can be reduced about 10 per cent by using a 3-in. insulated and vented cover for the tank.

▼

Hose Lines Safe on 132 Kv.

Tests with fire streams of varying diameter and length directed at the 132-kv. line at the Croydon grid substation lead to the conclusion that no special precautions need be taken when working at 40 ft. or more from a line of this voltage with nozzles having a diameter of ⅝ in. or less. If the nozzzles have a diameter of ¾ in. or more the distance should be at least 60 ft. To take care of shorter distances several alternatives are recommended—ground the nozzle through the hose to the hydrant, insulate the nozzle or use rubber gloves. In the *Electrical Review* report (July 14 issue) the resistance of a 27-ft. jet was found just under 2 megohms for nozzle cross-section areas of 1.6 or more square inches.

▼

READERS' FORUM

Vibration Forgotten With Dampers

To the Editor of the ELECTRICAL WORLD:

My attention has been called to a letter from R. A. Monroe of the Aluminum Company of America published in the ELECTRICAL WORLD of July 8 (page 62). I think Mr. Monroe and his associates in the Aluminum Company are entitled to receive some public testimonials for the highly scientific work done by them and the valuable practical results which they have accomplished.

On the last section of 132-kv. line built by the Montreal Light, Heat & Power, Consolidated, using A.C.S.R. conductors and a copper-clad steel ground wire, severe vibration was experienced both in the steel ground wire and in the A.C.S.R. conductors on a certain section of the line across a high, flat, open country where the prevailing winds blow approximately at right angles to the line. We erected an experimental line consisting of two conductors parallel to the operating line, in order to duplicate the vibration conditions and make extensive graphical records of the actual vibration. The Aluminum Company's engineers co-operated with our engineers in a very helpful way in obtaining these graphical records showing the amplitude and frequency of the actual vibrations.

They thereafter furnished us their "Stockbridge" type of vibration dampers of suitable dimensions to meet the existing conditions. These dampers were first installed on the experimental line and graphical records were taken showing the vibration before and after the dampers were installed. The severe vibration (large amplitude and high frequency) was reduced to a negligible quantity by these "Stockbridge" dampers. We thereafter installed these dampers on the entire section of line which had been affected by vibration, including both operating circuits and ground wires. The vibration trouble has been thereby eliminated and forgotten.

H. MILLIKEN,
Chief Engineer Electrical Department.
Montreal Light, Heat & Power, Consolidated.

Men of the Industry

W. E. Wickenden Heads S.P.E.E.

William E. Wickenden, president of the Case School of Applied Science since 1929, has been elected president of the Society for the Promotion of Engineering Education for the year 1933-1934. Mr. Wickenden is well qualified for the work he has been selected to direct, having been engaged most of his life in a study of educational and personnel problems. Following graduation from the University of Wisconsin he became a member of the teaching staff of that institution and of the Massachusetts Institute of Technology, and while with M.I.T. he made a study of educational problems for the engineering department of the Western Electric Company, which led to the creation of a personnel department of which he became manager in 1918. Later he was named chairman of the Western Electric Company's personnel committee.

In 1921 he was transferred to the headquarters staff of the American Telephone & Telegraph Company as assistant vice-president in charge of the recruiting and development of supervisory and technical personnel for the group of companies making up the Bell System. This work included the promotion of relations with universities and colleges throughout the country. Mr. Wickenden is a member of the American Institute of Electrical Engineers, the American Association for the Advancement of Science and the American Society of Mechanical Engineers.

▼

Dexter S. Kimball, dean of the College of Engineering, Cornell University, past-president of the American Society of Mechanical Engineers and of the Society for the Promotion of Engineering Education, was awarded the Lamme Medal at the recent annual banquet of the S.P.E.E. in Chicago. The medal is awarded each year by the Society "to a chosen technical teacher for accomplishment in technical teaching or actual advancement of the art of technical training."

•

Fred S. Hunt, Milwaukee manufacturer and attorney, has been appointed a member of the Wisconsin Public Service Commission for a six-year term. Mr. Hunt succeeds David E. Lilienthal, who resigned to become a member of the Tennessee Valley Authority.

▼

J. S. Norris Becomes Head of Beauharnois Power

Directors of the Beauharnois Power Corporation, Ltd., have elected J. S. Norris president of the corporation and chairman of the board and the directors of Beauharnois Light, Heat & Power Company, a subsidiary of Beauharnois Power, have elected him president and chairman of that company. Mr. Norris has been president of Montreal Light, Heat & Power Consolidated since the beginning of this year. The presidency of the Beauharnois corporation had been vacant for some time and the elevation of Mr. Norris is a further development of the reorganization plan now being effected following upon its recent approval by holders of Beauharnois securities (Electrical World, May 13, page 599).

Mr. Norris played an important part in the complicated work of amalgamating the gas and electric utilities which resulted in the formation of the Montreal Light, Heat & Power Company, of which he became secretary-treasurer in 1906. Four years later he was appointed general manager and in 1917 was elected vice-president and a director. He was selected for the newly created office of managing director in 1929, assuming the presidency early this year.

▼

D. C. Green Heads Middle West Utilities

D. C. Green, formerly a vice-president of the Electric Bond & Share Company, was elected this week president of the Middle West Utilities Company, central organization in the Insull utility system.

He will take complete charge of operating companies controlled by Middle West Utilities in eighteen states. Mr. Green succeeds Grover C. Neff, who has served as president since the receivership of the company. Mr. Neff will return to the presidency of the Wisconsin Power & Light Company.

Mr. Green has been with Electric Bond & Share in New York since 1929, when he came East after a long period of service in the public utility industry in the West. He started with the Byllesby interests in San Diego and before severing his connection with that organization he had successfully filled managerial positions with its subsidiary properties in Oregon, Washington and Arkansas. It was in 1923 that he entered the Electric Bond & Share system as vice-president and general manager of the Utah Power & Light Company.

▼

OBITUARY

Frank W. Peek, Jr.

Frank W. Peek, Jr., chief engineer of the Pittsfield (Mass.) works of the General Electric Company, and one of the company's specialists in high-voltage work, was killed July 26 when his automobile was struck by a train near Gaspé, Quebec. Mr. Peek was probably best known, both to the electrical engineering profession and the public, for his work in the field of lightning research. He had continued much

of the general line of investigation begun in the early years of this century by the late Charles P. Steinmetz, under whom Mr. Peek worked for a period during the early part of his career.

A Californian by birth and a graduate of Leland Stanford University, he became an employee of the General Electric Company in 1905, two years later beginning his original researches which first drew attention to him as an investigator of high-voltage phenom-

ena. After obtaining preliminary experience in the mountains of Colorado in the protection of electric transmission lines from lightning, he joined the newly formed consulting engineering department of the company under Dr. Steinmetz. During this period he established the laws of corona, or the loss of electrical energy during transmission, and also investigated line insulators. In 1916 Mr. Peek was transferred to the Pittsfield works of the company, where high-voltage engineering work was being undertaken. From that time onward he had been increasingly active in the investigation of lightning, and soon after Dr. Steinmetz built his first lightning generator at Schenectady Mr. Peek was building similar machines at Pittsfield, with gradually increased capacities. He continued his investigations, and in 1931 built a machine with a capacity of 10,000,000 volts, which at that time was the highest controlled voltage ever produced by man.

Mr. Peek had contributed repeatedly to the transactions of the American Institute of Electrical Engineers and other technical organizations. He was the recipient of the Thomas Fitch Rowland prize of the American Society of Civil Engineers in 1923, and the Levy medal of the Franklin Institute in 1926, awarded for "researches in physical science and engineering achievements in lightning." He was a fellow of the American Institute of Electrical Engineers and of the American Physical Society and a member of the Franklin Institute and the American Society for the Advancement of Science.

R. A. C. SMITH, some few years ago identified with light and power projects in Connecticut and Westchester County, N. Y., died July 27 aboard the *Majestic* in Southampton Harbor, England, shortly after the liner had arrived in that port from New York. Mr. Smith took part in the formation of the Westchester Lighting Company and the Connecticut Railway & Lighting Company and became president of the Connecticut utility, occupying that position at the time of his death. Mr. Smith was a former Commissioner of Docks of the City of New York. Born in Dover, England, he spent his early years in Spain and after coming to the United States became identified with Lyles & Gilson, dealers in railway supplies, and in this connection spent several years in Cuba and Latin-American countries. Subsequently he engaged in public utility work in Havana. Of his many business activities, that of shipping was one of the most important. In addition, he was at one time a director of the Metropolitan Street Railway Company, New York, and he was also connected with the American Tobacco Company, Albany & Hudson Railroad, International Banking Company and other enterprises.

New Equipment Available

High-Speed Heating Unit

An improved "Calrod" high-speed heating unit made of "Inconel" metal, equipped with a radically new glass-sealed terminal and new form of terminal connections, has been announced by the Edison General Electric Appliance Company, Chicago. Of the three major improvements one of the most important is the use of Inconel as the tubing from which Calrod coils are formed. Inconel (nickel chromium alloy) is essentially the same material as "calorite A," from which the resistance wire for the heating element is made. Inconel metal is non-rusting, non-crystalizing and will withstand extremely high temperatures without deterioration, it is claimed.

Glass-sealed terminals are a new development to prevent the deterioration which spillage has often caused in electric range units. As further protection against damage through spillage a new form of terminal connection has been designed. In these connections the grounded or neutral wire on the incoming circuit is connected to the two outer terminals, which are more exposed to spillage.

▼

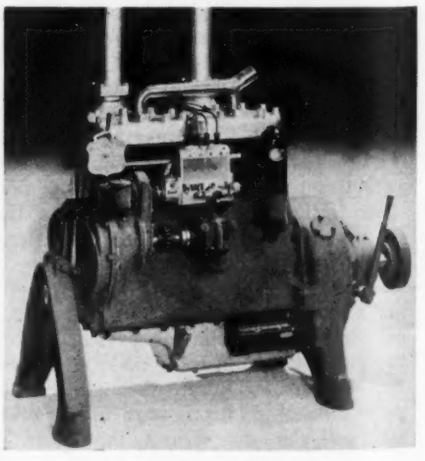
IMPROVED, AUTOMATIC, INSTANTANEOUS UNLOADERS for small refrigerator compressors are announced by the Electric Machinery Manufacturing Company. Elimination of forced shutdowns during voltage dips is offered by this line of apparatus which enables the compressor motor to "ride-through" the disturbance. The unloaders consist of an automatic pressure-differential-operated by-pass valve connected between the suction and discharge on the compressor. This valve operates by gas pressure differential and is controlled by a magnetic pilot valve which in turn is controlled by the frequency responsive relay on the motor starting panel. No springs are used and the mechanical construction is simple.

Automatic start and stop operation of the compressor units can be secured with use of the instantaneous unloader.

▼

Small Diesel for Generator Drive

A simple Diesel engine has recently been developed by the American Diesel Engine Company of Oakland, Calif. It is compact and sturdily made to drive generators. It starts electrically and runs at 1,200 r.p.m. synchronous speed. A governor controls speed within 3 per cent, assuring satisfactory generator performance, even on a.c. loads. The monovalve construction uses only one



valve per cylinder. This permits the use of conventional L-head design, which has been proved to be the most efficient to operate and practicable to build.

This new four-cylinder American Diesel develops 75 hp. at rated speed. The fuel consumption at 75 hp. is 0.44 lb. per horsepower-hour. It will be available in from one to eight cylinders, but throughout the entire line the same size of pistons, rings, rods, valves, etc., will be used.